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Official Reports of Costs of Producing Copper

A Comparison of Tabulated Statements of Costs of Mining, Smelting, Transportation and Administration from Reports of 22 Companies

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The accompanying tables show the costs of mining and producing copper as given in the reports of 22 copper-mining companies, which have been considered in this connection. The costs cover, in some cases, a period of four years, viz., 1904, 1905, 1906 and 1907. It sometimes happens that the fiscal years, which are covered by the reports, do not correspond with the calendar year so that the costs shown are not for the same period for all the companies named. In some cases the fiscal year ends on June 30, consisting of six months in one calendar year and six months in another; when this occurs the costs noted have been put in the year preceding that to which they are assigned by the company; arranged in this way they can be more fairly compared with the other costs. This lack of uniformity in regard to the period covered, somewhat impairs the value of the comparison, since the price of copper, the only element common to all the companies, has not been the same for all the periods of time shown; this defect is, however, unavoidable.

Five reports have not been obtainable for all four years. The report of the Dominion Copper Company prior to 1907 (which has here been called 1906, though its fiscal year ends July 31) does not contain sufficient information to deduce the cost of copper produced. The first annual report of the North Butte Mining Company was issued in 1905. In some cases companies have given certain information one year and withheld it the next, which will account for some of the incompleteness in the tables.

VALUE OF THE COMPARISON

In general, a study of the figures does not elicit as much information as it was hoped that it would. It has only been possible to tabulate the current mining, treatment and construction costs. To go further and derive from the reports the original cost of the property, the amount of money expended on it, and the production since the inception of the enterprise, requires more data than is available in most cases. The great difference in the bookkeeping methods employed to provide for the amortization of capital, sinking funds, capital redemption and so

on would make a tabulated comparison of little value, since it would not be a comparison of similar things.

The desirability of a uniform system of cost keeping is obvious, but considering the causes that produce the differences in the present methods of keeping costs it seems idle to devote any thought to such a remote possibility. In the first place the difference of the operations performed by various companies renders a radically different system of cost keeping desirable for their individual requirements. Then there are the individual ideas of the various men responsible for the forms of different cost systems. To change a set of books from one system to another for such an altruistic motive as rendering the costs of one company comparable with those of another seems such a remote possibility that it is hardly worth considering. Lastly there are probably cases, though I cannot at present give one, in which a certain confusion in the annual reports is deliberately sought in order to baffle attempts at analysis on the part of would-be investigators. Even were this end secured it is doubtful if it would result in much of value. The physical differences of different mining enterprises so far overshadow any similarities of method in working, that it is seldom that a comparison of the operations of one property with those of another will yield information of much value.

These tables were compiled with as much accuracy as possible and it is believed that such inaccuracies as have not been eliminated will not affect the conclusions to be drawn. In many cases what was properly chargeable to the cost of producing copper for any one year is a matter of opinion; I do not claim that the costs as given represent anything other than my opinion, with which anyone is at liberty to differ, and doubtless many will hold different opinions. Some cases have required assumptions which a more intimate knowledge of the affairs of the companies might alter. In general the figures given represent the deduction that would naturally be made from the figures which the companies themselves publish as to the conduct of their business. Where the income received from the sale of silver and gold has not been given, the silver has been assumed to bring 95 per cent. of the

ruling market price for any period, and the gold \$20 per ounce.

ARRANGEMENT OF REPORTS

Reports of mining companies vary widely in form. Some companies give simply a lump sum as the cost of their operations, while a few go into such detail that the cost of individual operations such as hoisting, mucking and hauling may be reckoned; this latter class is in the minority.

The tables show a column devoted to mining cost, one to cost of treatment, one to cost of administration and another to cost of construction. These four, when added together, give the cost of producing copper. Where there has been some revenue from sources other than the production of copper, this revenue has been segregated in the last column of the tables; the total cost of producing copper represents the sum of the first four columns less the figure given in the last column. Thus if the company derived revenue from the sale of gold and silver, rentals, interest on money, or from stores, it has been assumed that the cost of producing this revenue is equal to its production and the difference between the additional revenue and the total cost properly represents the cost of producing the copper. The cost per ton of ore treated is derived by dividing the tonnage treated (not always given) into the sum of the first four columns. In deducing the cost per ton it has not been thought correct to subtract the income from sources other than copper production.

The cost per pound of copper, as has been noted above, is derived by dividing the total costs, less the income from other sources, by the total pounds of refined copper produced. The cost per ton of ore is the best indication that we have of the sort of work that is being performed by any company. If the cost per ton is low, it may be assumed that the work is good and *vice versa*. The technical ability displayed may be excellent, however, and yet the enterprise may fail because of insufficient copper content in the ore. The cost per pound of copper produced is the figure that most interests the investor. From his point of view it is better to invest in a company with careless methods of operation, but whose high copper value per-

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mits a large margin of profit, than in one in which the exercise of the highest technical ability and constant watchfulness barely permit a profit to be made.

CONDITIONS OF THE VARIOUS COMPANIES

It is only necessary to know the market prices for copper and glance at the column "Cost per Pound" to see which companies were in the best position to pay dividends during 1904, 1905, 1906 and 1907. There are two other considerations, however, which the table has not included. One is the capitalization of the company, which is a purely financial consideration, and need only be briefly touched upon in this connection.

When the cost of producing copper of some company is seen to be low per pound of copper produced, the last word has not

pound of copper produced, indicating to one not acquainted with the operations, a wide margin of profit; and yet it may all the while be gutting the mine of its best ore and leaving poorer ore, which would undoubtedly yield a narrower margin of profit, but with a considerable lengthening of the life of the mine. The precise point at which it is advisable to stop in treating low-grade ores, the considerations being those of increased life of mine against lower rate of interest on money invested, is a hard one to decide and must be separately worked out for each individual case.

The second consideration, which affects the value of each mining enterprise, and which my tables do not include, is that of future ore reserves. While the annual reports of the companies considered treat

reports of engineers is one of the problems for time to solve.

CLASSIFICATION OF COSTS

The classification of the costs under mining, treatment, administration and construction is misleading. It represents little more than the original intent of the investigation before it was undertaken. The only three companies, the costs of which have been correctly segregated, are the Tennessee Copper Company, Dominion Copper Company, Ltd., and Utah Consolidated Mining Company. The apparent classification of the others is not correct. In order to justify this a few words of explanation are necessary regarding the order of tabulation. The first table includes 15 Lake Superior companies, all of which use a certain form for their reports.

COMPARISON OF COSTS OF SEVERAL COPPER PRODUCING COMPANIES IN 1904, 1905, 1906 AND 1907.

Company.	Year.	MINING.	TREATMENT.	ADMINISTRATION.	Construction. Purchase, etc.	Total Cost.	Tons Ore Treated.	Cost Per Ton.	Copper Produced, Lb.	Cost Per Lb.	Per Cent. Copper.	Revenue From Sources Other Than Copper Production.
		Running Expense at Mine.	Smelting, Freight, Refining, etc.	Taxes, Interest, Commissions, etc.								
Dominion Copper.....	1904 1905 1906											
		\$325,144	\$347,612	\$67,242		\$506,549	187,981	\$3.94	2,910,695	\$0.1740	0.774	\$233,454
Granby Con. ⁵	1904 1905 1906	2,036,495 2,927,441 2,596,611			\$486,577 1,287,213 462,760	1,541,693 3,009,253 2,182,952	590,120 832,346 665,915	4.28 5.06 4.59	14,237,622 19,939,004 16,410,576	0.1083 0.1509 0.1330	1.206 1.198 1.232	981,380 1,205,401 876,419
Greene Con.....	1904 1905 1906 1907 ²					7,314,582 8,290,312 7,298,708 10,784,632	485,079 734,018 936,318 1,552,884	15.93 11.29 7.80 6.95	55,014,339 77,991,946 55,943,738 58,180,856	0.1330 0.1063 0.1304 0.1854	5.671 5.312 2.881 2.329	412,819 336,654 ¹ 64,398 734,024 ⁴
North Butte.....	1904 1905 1906					1,605,862 2,324,706			30,954,788 32,865,907	0.0519 0.0707		679,255 ² 746,975
Shannon.....	1904 1905 1906					2,576,949 1,823,080 2,484,634	188,856 218,402 209,654	13.76 8.49 12.28	11,414,271 11,215,832 13,609,000	0.2258 0.1625 0.1826	3.022 2.568 3.245	21,961 30,532 89,528
Tennessee.....	1904 1905 1906 1907	364,574 229,218 347,580 446,701	418,667 414,208 739,149 948,625	122,478 104,438 132,427 117,219		905,719 747,864 1,219,156 1,512,546	241,855 229,116 362,900 389,603	3.79 3.26 3.36 3.88	8,188,897 8,260,982 11,319,591 12,599,019	0.1106 0.0905 0.1077 0.1222	1.693 1.803 1.559 1.617	
Utah Con.....	1904 1905 1906 1907	396,902 546,822 577,558	839,291 988,355 1,289,670	59,431 55,702 71,841		681,988 806,370 779,938	223,700 286,200 296,989	5.73 5.56 6.53	13,553,483 17,264,474 18,533,974	0.0503 0.0467 0.0421	3.030 3.016 3.120	613,636 784,509 1,159,131

¹ Total copper includes 15,169,653 lb. copper produced in 1904 and sold in 1905.

² First annual report made in 1905.

³ For 17 months from Aug. 1, 1906, to Dec. 31, 1907, on account of change from fiscal year to calendar year.

⁴ Value of gold and silver in period of 17 months.

⁵ Fiscal year ends June 30.

been said respecting the margin of profit from which the investor must expect to draw his dividends. The copper may be produced at low cost per pound and yet the total quantity produced may be small in relation to the capitalization of the company, so that a relatively large margin of profit per pound of copper produced may be relatively small when spread, in the form of a dividend, over a large quantity of outstanding stock. The lower costs per pound of copper produced will be found on inspection to correspond with the higher tenor of the ores treated. Here is where the investor is at the mercy of the men who control the policy of his company. By selecting the best ore either by selective mining, or by sorting, a company can treat ore of a high grade only, show a high cost per ton probably, but a low cost per

this matter more or less fully, there is little comfort to be derived from the statements of many; nor can I see how the lay investor can protect himself against deception, or, what is far more to be feared, self-deception on the part of those who compile the reports. The art of mining engineering (and I use the word "art" instead of "science" advisedly) reaches its culmination when an engineer correctly forecasts the quantity and value of ore to be extracted from a mine. The difficulties attending this are too numerous to mention here, and yet at the moment when investment in any mine is contemplated, it is the one feature that overshadows all others. The proper training of engineers to estimate ore reserves correctly, and the proper training of the public to exercise intelligence in accepting the

This similarity, representing, as it does, similarity of operations, made it advisable to place them together since their costs are more justly comparable with one another. In some cases their costs are given in commendable detail which would permit a correct segregation according to the classification made; but it has been considered best to segregate their costs in the same manner, followed by the other companies with which they are compared. As noted before, this is misleading. Thus under the head "Mining," there is included a large portion of the treatment cost which the companies do not separate from their mining cost. Under the head "Administration," it was the intention to segregate office expenses, legal expenses, taxes, commissions, interest, travelling expenses, and all expenses not fairly

chargeable to operation. This classification is as correct as the information (sometimes very limited) contained in the reports permitted. Where no administration costs are noted it can be assumed that the costs of administration have been

costs given, though the other costs have been given in detail. In these cases, and they are the reports that permit of a correct classification, the current construction has been made part of the current operating costs in the proper

CONSTRUCTION
Frequently construction is made to appear as an unusual expenditure in the reports, and to one considering a single report of a single company it would appear to be an unusual expenditure which

COMPARISON OF COST OF PRODUCING COPPER, 15 LAKE SUPERIOR COMPANIES, IN 1904, 1905, 1906 AND 1907.

Company.	Year.	MINING.	TREATMENT.	ADMINISTRATION.	Construction, Purchase, etc.	Total Cost.	Tons Ore Treated.	Cost Per Ton.	Total Lb. Copper Produced.	Cost Per Lb.	Per Cent. Copper.	Revenue From Sources Other Than Copper Production.
		Running Expenses at Mine.	Smelting, Refining, and Other Expenses.	Taxes, Interest, Commissions, etc.								
Adventure.	1904	\$241,331	\$25,788	\$11,131	\$1,929	\$280,179	97,036	\$2.887	1,380,480	\$0.20290	0.711	
	1905	295,984	21,492	9,550	14,195	341,221			1,606,208	0.21244		
	1906	281,964	21,583	8,213	37,079	348,839	136,094	2.563	1,552,628	0.22468	0.570	
	1907	259,759	19,485	7,932	19,272	279,635			1,244,874			\$26,813 ^a
Allouez.	1904	86,825		10,057	62,341							
	1905	199,275	23,790		87,451	310,516	41,120	7.551	1,167,957	0.26586	1.470	
	1906	341,241	53,554		82,630	477,425	178,400	2.676	3,486,900	0.13691	0.977	
	1907	401,975	48,887		172,589	623,451	214,720	2.905	2,934,116	0.21248	0.683	
Atlantic.	1904	533,273	65,765		5,229	604,267	390,526	1.547	5,321,859	0.11354	0.681	
	1905	512,025	50,321		15,095	577,441	295,220	1.956	4,049,731	0.14259	0.685	
	1906	219,811	22,389		65,803	308,003			1,439,082	0.21403		
	1907	114,494				122,288						
Baltic.	1904	835,647	160,445	29,486	65,583	1,091,161	535,624	2.036	12,177,729	0.08960	1.137	
	1905	908,776	179,066	43,856	75,552	1,207,250	604,709	1.996	14,384,684	0.08393	1.137	
	1906	990,050	172,546	43,081	178,273	1,383,950	649,932	2.131	14,397,557	0.09612	1.107	
	1907	1,191,825	216,583	53,896	265,782	1,728,086	761,288	2.270	16,704,868	0.10344	1.097	
Centennial.	1904	231,334	27,735		91,846	350,915	69,453	5.052	641,294	0.54720	0.462	
	1905	257,622	42,761		47,899	348,282	84,890	4.103	1,446,584	0.24076	0.852	
	1906	308,147	58,817		75,665	442,620	166,000	2.667	2,253,015	0.19646	0.679	
	1907	433,727	36,255		64,193	534,176	200,040	2.670	2,373,572	0.22506	0.593	
Champion.	1904	706,118	166,132	63,076	209,149	1,144,475			12,212,954	0.09371		
	1905	1,001,841	203,380	115,384	147,177	1,467,782	604,483	2.428	15,707,426	0.09338	1.2992	
	1906	1,110,191	210,342	71,978	174,380	1,566,891	671,785	2.332	16,954,986	0.09242	1.2619	
	1907	1,200,416	216,549	76,116	446,374	1,939,455	708,685	2.737	16,489,436	0.11762	1.1634	
Franklin.	1904					657,416	389,470	1.688	4,771,050	0.13780	0.612	
	1905					668,076	374,130	1.785	4,206,085	0.15883	0.562	
	1906					738,395	372,378	1.983	4,368,538	0.16903	0.586	
	1907	521,507	197,975		18,356	737,837	383,290	1.783	4,401,248	0.16764	0.574	
Isle Royale.	1904	235,000	53,782		36,065	324,847	154,830	2.098	2,442,905	0.13297	0.788	
	1905	273,340	60,803		45,269	379,412	195,150	1.944	2,973,761	0.12758	0.762	
	1906	294,556	64,178		72,637	431,371	192,210	2.244	2,937,098	0.14687	0.765	
	1907	365,370	62,419		335,871	763,660	175,450	4.352	2,667,608	0.20260	0.760	
Mass Con.	1904	188,434	41,481	28,219	26,909	283,687	105,614	2.686	2,182,931	0.12996	0.832	1,356 ^b
	1905	207,314	44,275	27,865	115,460	393,342			2,007,950	0.19539		1,572 ^b
	1906	400,909	51,860	25,170	42,387	518,660			2,106,739	0.24620		1,666 ^b
	1907											
Mohawk.	1904	653,282	87,874	8,467	178,400	928,023	459,162	2.021	8,149,515	0.11387	0.888	
	1905	811,542	94,631	10,552	131,687	1,048,412	586,305	1.788	9,387,614	0.11168	0.800	
	1906	884,712	100,452		93,873	1,079,037	618,543	1.744	9,352,252	0.11538	0.756	
	1907	986,922	97,107		103,353	1,187,382	640,777	1.540	10,107,266	0.11747	0.789	
Osceola.	1904	1,646,374	259,642		132,983	2,038,999	1,095,520	1.861	20,472,429	0.09960	0.935	
	1905	1,575,690	239,429		207,505	2,003,493	1,007,200	1.989	18,938,965	0.10578	0.940	19,131 ^a
	1906	1,623,511	244,629		155,482	1,888,084	1,016,240	1.858	18,588,451	0.10157	0.915	135,538 ^a
	1907	1,497,112	177,066		84,374	1,687,179	811,603	2.079	14,134,753	0.11936	0.870	71,373 ^a
Tamarack.	1904	1,576,924	203,627		161,958	1,942,509	642,320	3.024	14,961,885	0.12983	1.165	
	1905	1,789,243	239,875		86,413	2,115,531	750,120	2.820	15,824,008	0.13369	1.055	
	1906	1,255,579	157,504		90,517	1,439,823	389,680	3.695	9,832,644	0.15290	1.260	63,777 ^a
	1907	1,587,483	164,353		93,412	1,822,457	533,600	3.415	11,078,604	0.16666	1.040	22,791 ^a
Trimountain.	1904	834,752	124,872	49,822	64,519	1,073,965	534,640	2.009	10,211,230	0.10517	0.955	
	1905	908,958	139,743	52,264	44,225	1,145,190	570,843	2.006	10,476,462	0.10931	0.918	
	1906	925,055	122,189	43,033	74,250	1,156,206	506,942	2.281	9,507,933	0.12055	0.938	8,321 ^c
	1907	870,491	109,513	45,094	66,084	1,026,464	444,358	2.310	8,190,711	0.12532	0.922	64,718
Quincy.	1904	1,594,711	144,575	49,535	106,002	1,867,193	1,018,873	1.832	18,343,160	0.10178	0.900	27,630 ^c
	1905	1,715,419	139,097	51,406	138,732	2,015,469	1,135,162	1.775	18,827,557	0.10704	0.829	29,285 ^c
	1906	1,662,520	114,568	62,833	138,559	1,951,070			16,194,838	0.12048		27,410
	1907	2,012,085	164,289	55,276	210,700	2,420,829			19,796,054	0.12130		21,521 ^c
Wolverine ^d .	1905	496,061	109,373		5,111	604,067	321,813	1.877	9,729,971	0.06208	1.512	6,478 ^e
	1906	529,668	99,729		35,968	654,321	341,820	1.914	9,681,706	0.06758	1.416	11,044
	1907	569,470	99,565		42,137	695,974	344,062	2.023	9,372,982	0.07424	1.362	15,198

¹ About one-tenth of product comes from mass copper.
² Value of silver deducted from total cost.
³ A large proportion of the product is obtained from mass copper; hence no figures per ton are given.
⁴ Deducted from total cost; income from other sources than production.
⁵ Interest; deducted from total cost; income from other sources than production.
⁶ Interest.
⁷ Fiscal years ending June 30.

allotted in their proper proportion to the operating costs.

The last cost column, "Construction," represents the loosest designation of all, the correctness of which can most readily be assailed. In a few instances it will be noticed that there are no construction

departments. In my opinion this method is correct, and should be more generally employed. The term "construction" in the table includes all unusual expenditures such as purchase of new properties, new machinery and new construction as well as current construction.

would not occur again; hence, in deducing the cost of producing copper from the report he would omit it and would be misled into believing that copper could be produced at a lower figure than is the case. It is only when the reports over several successive years are considered

together that the impropriety of this practice becomes apparent.

From a perusal of the table it becomes apparent that those companies that segregate their construction costs have a recurrence of them with such regularity that in order to arrive at the annual cost of producing copper it is necessary to include these costs with the operating costs. It will be noticed that the companies that have been operating for years are just as apt to have an annual construction cost as those that have just commenced operating. On reflection this does not seem extraordinary, for anyone who has had experience with seemingly complete mining plants, can testify that in spite of their apparent completeness they require something new every year.

In making this classification under construction the principle followed has been, that any expenditure in connection with the company's property which had to be paid for out of the earnings of a given year properly belonged in the cost of producing copper for that year. This is the view taken by the Dominion Copper Company, Ltd., Tennessee Copper Company and Utah Consolidated Mining Company; these companies report no construction costs but charge construction in any department to the operating expense in that department. From the point of view of the stockholder this is a great advantage. To be sure, the stockholder cannot be so sure of the quality of work being done unless costs are given in detail, and he is able to make a more extensive classification for himself; but few have the knowledge or the energy to do this. Good work, producing a low operating cost, may be offset by a larger quantity of construction than usual; and poor work, with high operating cost, may be made to show a low cost by failure to perform needed construction in the case of companies that make their construction part of the operating costs of the respective departments. Construction should be indicated; but in the long run the interests of the investing public will best be served by making construction costs part of the operating costs of their respective departments.

Theoretically the construction of a plant that will last several years is not justly chargeable to the operating cost of the year in which it was built, and there are excellent systems of mine bookkeeping that permit the proper allotment to each operating cost of its share in any new construction. Almost any degree of difference in the cost of producing copper can be obtained by excluding this or that item, on the ground that it is an extraordinary expenditure, that it will not occur again, etc. Anyone who spends much time in working out such costs cannot fail to be impressed with the fact that the elaborate systems of cost-keeping which provide for the correct distribution of construction costs do not, after all, ac-

complish much. The sums listed under construction do not vary any more or any more irregularly in relation to the amount of ore mined than do the other costs.

OPERATIONS REPRESENTED IN THE TABLES

The Lake Superior companies listed in the second table mine an ore (locally called "rock") containing metallic copper. Their operations consist of mining, crushing in what is locally termed the "rock house," stamping under steam stamps, concentrating and smelting either at their own or at the Michigan smeltery. The seven companies represented in the other table treat their ore in a variety of ways, and make various products such as matte, blister copper, bessemer copper and ingot copper. They all carry on smelting operations; in some cases they smelt all the ore directly, but the majority concentrate a part of it and smelt the concentrate. The practice of the seven companies in the second table and the conditions under which they operate are much less uniform than those listed in the first table. Mining in the Lake Superior district has been carried on for so many years under comparatively similar conditions by so many companies, that it almost constitutes a system of mining in itself.

The Lake Superior companies, with a few exceptions, produce only copper. The exceptions, the Mass-Consolidated Mining Company and the Quincy Mining Company, produce a small quantity of silver.

The seven companies represented in the first table, with only one exception, the Tennessee Copper Company, which produces copper only, treat ores carrying gold and silver, the value of which is represented by the sums listed in the last column of the table.

A study of the figures is interesting. One is at once impressed by the low cost per ton of the Lake Superior companies and by the low percentages of copper from which they extract profits. In most cases the cost per pound of copper is not low because of the low copper content, but the low per-ton costs show what economical mining the companies are doing. The Wolverine Copper Mining Company with its higher copper content is able to make a much better showing per pound of copper produced than the others, maintaining at the same time a per-ton cost as low as the average. The only company which approaches the Wolverine in cost per pound of copper produced is the Utah Consolidated Mining Company, which derives a substantial income from the gold and silver in its ore, and moreover the ore has double the copper content of that of the Wolverine. The high cost per ton of ore treated by the Greene Consolidated Copper Company and the Shannon Copper Company may well excite comment. In the case of the Greene Consolidated Copper Company its former ability to pay

dividends and show a fair cost per pound of copper produced is traceable to the high copper content of the ore, the highest of any of the companies named in the tables. When the grade of the ore ran down, the cost of production increased to a high figure.

Flood-Gold

The principal characteristics of flood-gold, according to C. W. Purington (Bulletin No. 44, Ins. Min. and Met.), are its distribution at and near the surface of the gravel bars in streams rather than throughout the section, and its fine, flaky nature. Flood-plained streams, characterized by curves, in wide valleys burdened with gravel, are the usual areas in which this kind of gold occurs. The richest bars are found on the up-stream side of the convex curves of the river, and in the corresponding portions in the former channels occupied by the river. The causes responsible for the enrichment of the bars are, undoubtedly, periodical floods. Such areas of flood-gold generally occur at distances of from 30 to 70 miles from the original sources of the gold in question.

Flood-gold constitutes a phenomenon of subordinate or parallel importance in river valleys where a portion of the alluvial gold is of more ancient origin. For example, in the California dredging areas of the Feather and Yuba rivers, the drill prospecting indicates that occasionally the richer gravel lies near the center, or even in the upper portion of the vertical section of the gravel, while all the operators who have investigated the subject agree that notwithstanding the profitable recovery that is made, the finest gold is not saved either in the rocking of samples or on the dredge tables, but is carried away with the water in washing.

The distinction in physical form between flood-gold and that which is slowly transported and deposited in stream channels affords an illustration of the selective action of running water. The flood gold is invariably flaky, although the particles may present a comparatively large surface. On the other hand, gold deposited in the bed-rock pay-streaks of small streams may be extremely finely divided, but will have a form approaching the spherical.

In the examination of auriferous river gravels to determine if they may be profitably worked by dredges it may be said that, with very rare exceptions, the gold deposited and constantly shifted by annual floods must be neglected in the sampling, not only because of the irregularity of its horizontal and vertical distribution, but because of the extreme difficulty in recovering it by the appliances ordinarily used in placer mining.

One cu. ft. of water weighs approximately 62.5 pounds.

Some Metallurgical Processes at Pachuca, Mex.

The Older Processes Are Rapidly Being Displaced by Cyanidation;
Even the Old Tailings Are Treated Successfully by This Process

BY CLAUDE T. RICE

With the exception of the hyposulphite lixiviation process all the leading wet processes or modifications of them have been tried at Pachuca. Even now the patio, the pan-amalgamation, the Kröncke barrel and the cyanide processes are in operation, and only a few years ago a modification of the Franke process was also in operation.

Many metallurgists visit Pachuca, attracted by the diversity of the processes in use and the equipment of the mills. South Africa as well as Australia has had its representative at Pachuca, for the Adair-Usher process was given a short trial at the cyanide plant of the Blaisdell Coscotitlan Syndicate on the flat below town. This process briefly consists in

The old refinery at the Loreto mill is also interesting. This refinery is not in operation at present as the Real del Monte y Pachuca company is working on plans for remodeling and modernizing it. This plant is one of the few custom refineries for treating only a mill bullion.

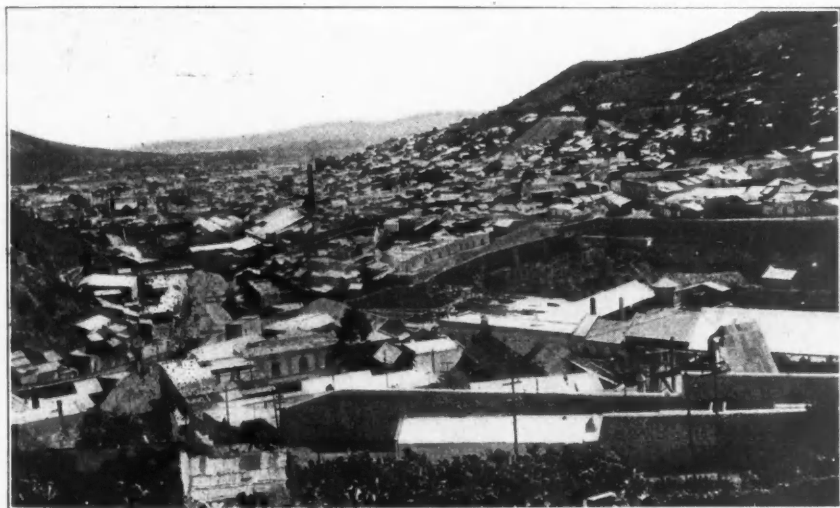
THE PATIO PROCESS

At the Guadalupe *hacienda*, where the patio process is used, about 1000 tons of ore per week are treated; the ore comes from the Santa Gertrudis and Amistad mines. At the mine the ore is spalled or crushed, and then sorted so as to remove the waste, as well as the ore assaying 2 kg. silver per ton. At the mill the ore is passed through trommels having $\frac{1}{2}$ -in. openings,

torta; then the salt is mixed into the moist slime; after that the copper sulphate is added and the *torta* is treaded with horses. In Medina's time men mixed the *torta*, and even now, after the horses have stopped work for the day, men turn over every part of it to insure thorough mixing. After the copper sulphate has been mixed, the mercury is added and the tramping begins again. About 14 tons of salt, one ton of copper sulphate, and 500 to 1000 kg. of mercury are mixed with the pulp; this amount of quicksilver sprinkled through the cloth bag onto the *torta* depends upon the amount of silver in the ore. Toward the end of the process more mercury—about one-half of the original amount—is added in order to collect the amalgam already formed. The tramping of the *torta* lasts from 30 to 35 days. Toward the end the ore is frequently tested by panning the slime and squeezing the amalgam obtained between the thumb and finger in order to judge from the resulting ball how far amalgamation has progressed. During this long period of tramping considerable water evaporates; so whenever the slime gets too sticky for the horses to work it easily small quantities of water are added. The one desirable thing is to keep the *torta* as thick as possible so that the globules of mercury, scattered through the ore by the tramping of the horses, will be as long as possible traveling to the bottom.

Finally, when the tests made by fire assay on the tailing have shown that the extraction has progressed as far as it is economical, water is added, tramping is continued for a short time to collect the amalgam, and then the charge is washed to several settling pans. At this *hacienda* concrete settlers with revolving arms, built in a pit at the head of the tail sluice, are used. The sluice is fitted with amalgamating riffles to catch quicksilver or amalgam in the tailings.

Men then sweep the patio with brooms, driving the mercury and amalgam before them until finally it goes to the settlers, where it is collected. The extraction of the silver is from 80 to 85 per cent. while the extraction on the gold is very low, only 30 to 40 per cent. This low extraction on the gold is one of the great objections to the patio process. Another disadvantage is the large number of horses required (at the Guadalupe *hacienda* 500); these must be replaced in considerably less than two years, for a young horse will only last two years and an old horse often only six months. With



PACHUCA; PROGRESO MILL IN MID-DISTANCE

agitating the pulp by means of cyanide solution entering near the bottom of the tanks through radial arms extending from a central vertical supply pipe. For success with this process it is essential to have a clear overflow at the periphery of the tank. At Pachuca, where the agitation of an unclassified sandy slime was attempted, a clear overflow could not be obtained when the agitation was strong enough to keep the granular slime in suspension. On this account and for other reasons the Adair-Usher process was abandoned and Blaisdell movable agitators used for agitating the slime. The cyanide plant of the Blaisdell Coscotitlan Syndicate is metallurgically one of the features of Pachuca, for there the cyanidation of old tailings from the patio, the barrel, and the pan-amalgamation processes are being worked out.

and the oversize is crushed in jaw breakers. This oversize rejoins the undersize from the trommels and then goes to 14 Chilean mills, 5 ft. diameter, crushing through 60-mesh screens. The pulp from the Chilean mills is elevated to 28 Johnston tables, where a good part of the gold is saved in the concentrates. The tailing from these tables goes to settling tanks from which the thickened pulp goes to the patio for treatment.

The Guadalupe *patio* is large, being capable of treating at one time 18 *tortas*, or slime beds, 25x30 m. long (including the small space between the *torta* and the inclosing wooden beams). This *torta* is 30 cm. thick and contains about 300 tons of dry slime. After draining and drying for one day, salt is dumped from *botes* into regular piles on top of the charge, so as to insure an even distribution in the

the exception of the horse for the driver to ride, only unbroken horses are used; these cost at present from 18 to 20 pesos each.

To decrease this expense due to horses the mechanical mixer was invented. This consists of a rectangular framework about 20x5 m., inside of which another framework, to which are fastened eight plows, travels back and forth as it is fed ahead by a cable and wheel. The whole is carried on wheels which run on a track placed on top of the low walls inclosing the mixer *torta*. At one end of the mixer yard is the engine which slowly moves the mixer over the *torta* by means

too near the end of its existence to warrant the invention of a mechanical beater.

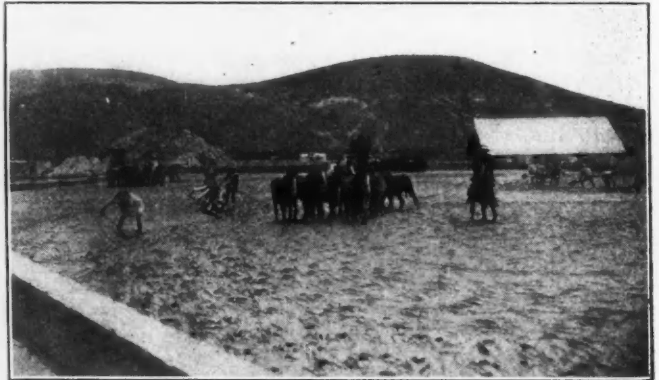
Although at first it took a long time to accomplish advances in this venerable process (200 years to substitute horses for men in mixing), it is not any clumsiness in mechanical details that has caused the slow decline in the process, for the visitor to a *patio* in operation soon acquires a respect for the process which he never acquires from books. Mexico can well be proud of having contributed the *patio* process to civilization, but as with many other things that have served efficiently, the time of the treading of the last *torta* is only a few months hence.

then dumped over grizzlies having 1¼-in. openings between bars.

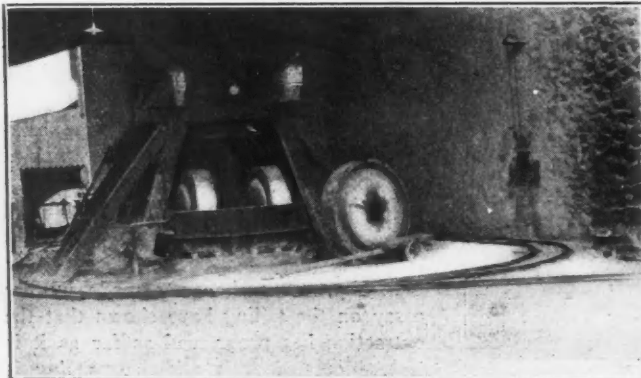
There are three grizzlies each of which feeds the oversize to a 9x12-in. Blake crusher; these break the ore to 1¼-in. size. The crushed oversize and the undersize from the grizzlies fall into the battery bin and are fed by suspended Challenge feeders to fifty 1050-lb. stamps making 102 drops, 7 in. high, per min. At the stamps very little water is added (only 1.2 to 1.4 ton of water to 1 ton of ore) for no pulp thickeners are used above the pans. On the batteries a 20- or a 14-mesh screen is used according to the hardness of the ore, but most of the



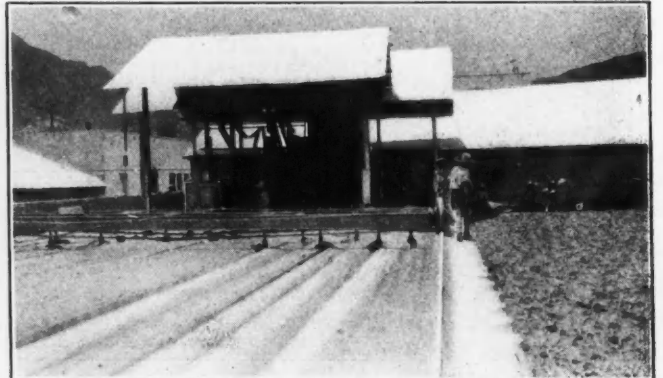
TORTA COVERED WITH SALT ON LEFT



HORSES TREADING; MEN TURNING A TORTA



CHILEAN MILL; GUADALUPE HACIENDA



MECHANICAL MIXER; GUADALUPE HACIENDA

of an endless cable. By means of the plows the *torta* is turned over, but the mixer does not scatter the mercury through the slime so thoroughly as do the horses. It is said that it takes several days longer to obtain, by means of the mechanical mixer, the same extraction as by means of horses. This is probably due to the fact that the plow simply turns over the slime so that possibly much of the mercury flows to one side as the plows pass, while the horse's hoof striking a pool of mercury scatters it as small globules through the slime. Besides, the comminution increases the amalgamating surface of the mercury and so shortens the period required for the mercury to come in contact with the different silver particles. In the mixing of the *torta* a beating action is required more than a shoveling action, but the *patio* process is

THE PROGRESO OR SAN FRANCISCO No. 2 MILL

The Progreso mill, which belongs to the Compañía Beneficiadora de Metales, the same company that owns the San Francisco No. 1 mill, is still using pan-amalgamation although plans are being drawn for a cyanide plant which will be submitted at the next annual meeting of the company. This mill is treating custom ore entirely, consequently the ores treated vary greatly in character, for the company receives ore from almost all the mines in the Pachuca district.

The ore comes to the mill in cars over the tramway from the different mines and is unloaded into *botes* packed by two men, as this is cheaper than installing a bin and belt-conveyer system. The ore, as it is unloaded, is sampled by hand and

crushing is done in the six Kinkead mills that are used for regrinding the pulp from the batteries. On these mills 30-mesh screens are used so that the ore is finely ground as is shown by the following screen test. On 30-mesh, 0.78 per cent.; 30 to 40, 0.67 per cent.; 40 to 60, 6.53 per cent.; 60 to 80, 5.14 per cent.; and through 80-mesh, 86.88 per cent. Since in the pan-amalgamation, as well as in the cyanide process, the extraction increases with the fineness to which the ore is ground, this is a very good pulp for the process. The repair bill on the Kinkead mills is said to be small and the mills give good satisfaction.

The pulp from the Kinkead mills goes to two 8-ft. mixers where live steam sufficient to raise the temperature of the solution to 60 deg. C. is mixed with the solution, and a large excess of powdered

copper sulphate and salt is added to the charge. From the mixers the pulp goes to the first of 16 five-foot pans, which overflow from one to another. At the pans the mercury is added, it taking about 5320 lb. to charge the 16 pans. But as there is always some mercury tied up in the amalgam, not only in the pans, the settlers and the amalgam traps, but also as partial retort charges left over after retorting (for only full charges weighing 2530 lb. of amalgam are retorted), it is necessary to keep from 7 to 10 tons of mercury on hand. This mercury at present comes from the La Cruz y Anexas mine in Guerrero, but formerly

rotate, while in the launders leading to the river copper riffles are placed. Considerable floured quicksilver together with some amalgam is caught both in the traps and in the riffles, the copper riffles gradually becoming coated with amalgam.

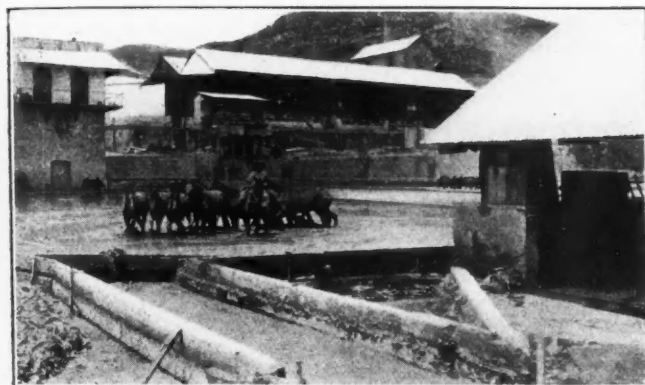
The bullion obtained from the retorted amalgam is generally not nearly as fine as that obtained by the cyanide process on the same ore; at this mill it varies between 400 and 900 fine, copper being the chief impurity.

The cost of pan-amalgamation is greater than cyanidation. This is due to loss of mercury and the excess of salt and copper sulphate necessarily added to the ore.

this mill as it has already at the San Francisco No. 1 mill.

LA UNION HACIENDA

At the La Union *hacienda* a modification of the Kröncke barrel process is still in use; but four Pachuca tanks for agitating the pulp are being erected and in a few weeks the cyanide process will be used instead of the older process. The ore, after being crushed in breakers, is ground in Chilean mills of the Walker type. In these almost all the ore is reduced to a slime. Tests that Señor Francisco Narvaez, the manager for the company, has made indicate that the Chilean



FINAL TREADING OF THE TORTA



COLLECTING AMALGAM AND SWEEPING PATIO



LOADING TAILINGS; BLAISDELL COCOSTITLAN SYNDICATE



RECEIVING BINS; BLAISDELL COCOSTITLAN SYNDICATE

mercury was obtained from other Mexican quicksilver mines.

The amalgam works over into the amalgam well connected with the pan and is cleaned out frequently, the excess mercury being drained off through bags. From the pans the pulp goes to four 8-ft. settlers where it is diluted with water until there is about $4\frac{1}{2}$ parts water to 1 part dry ore. These overflow from one to another, and in them amalgam and floured mercury are collected. The overflow from the last settler goes to a classifier which feeds the sands to five New Standard concentrating tables and the overflowing slime to six Johnston tables. The tailings from the concentrators go to three mercury traps in which stirrers

Since in the pan-amalgamation process experiment has failed to show any rule governing the amount of chemicals required for different classes of ore, at a custom mill treating many different classes of ore an unusually large excess of chemicals must be used to insure good extraction.

The extraction of silver in the pan-amalgamation process compares favorably with that obtained by the cyanide process, but the gold extraction is far lower. Therefore, partly on account of the lower gold extraction, but mainly—since Pachuca ore carries but little gold—on account of the greater cost of the process, it is only a question of time before the pan-amalgamation process will succumb at

mills are more economical in crushing the ore than tube mills, so the Chilean mills will be retained when the plant is modified. The ore from the Chilean mills is dewatered; then it is charged into wooden treatment barrels where cuprous chloride, some copper sulphate, mercury and salt are added. The metallic iron in the pulp precipitates the silver and mercury from the silver and mercurous chlorides that are formed by the action of the chemicals on the silver in the ore and the mercury added to the charge; the mercury then amalgamates the precipitated silver. The resulting amalgam is allowed to accumulate in the barrel and is cleaned up once a month. When the iron in the pulp is insufficient for complete precipitation of

the silver, sufficient zinc is added to complete the precipitation. Each barrel holds 4.7 tons of dry pulp. After the charge is made up the barrel is rotated for four hours. Filling and emptying takes four hours so that it takes eight hours to complete a cycle. The extraction on the silver is high, being as much as 95 per cent., but the extraction on the gold is only 35 to 75 per cent. The cost of the process is high compared with that of cyaniding. In the remodeled plant the crushing part of the mill will remain the same and only the chemical treatment will be replaced by the cyanide process.

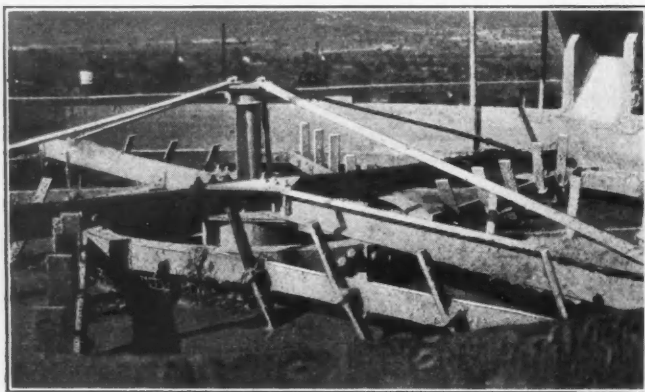
Thus we see that the older processes

gate their ranches. But Pachuca has always been the scene of much milling and consequently this water was heavily laden with the tailing from the patio, the pan-amalgamation and the barrel-process mills. In all these processes most of the ore is ground to a slime and even the sand is very fine. Consequently the *haciendados* have had to build dams to impound the water and settle the slime and sand which was ruining their farms. Thus a shallow tailing, which has gradually encroached upon the farm land, has accumulated for years.

Over a year ago the promoters of the Blaisdell syndicate, believing in the pos-

movable agitators are installed, quite similar in construction to the Blaisdell excavator except that they have paddles instead of disks on the revolving arms. These will travel on a track over each line of slime tanks. Through the agitator paddles it is possible either to blow air or to spray solution so as to aid the agitation. Formerly the Adair-Usher process of agitation was tried, but with the sandy slime more violent agitation was necessary.

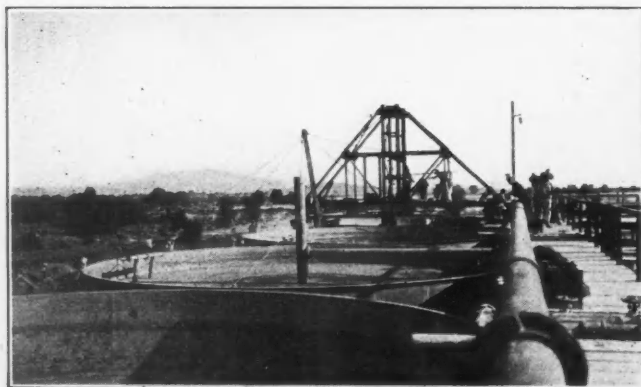
The tailing, as has been said, is thin and as labor is cheap the material after being loosened by a disk plow and harrow is shoveled into the cars on the auxiliary tracks that are placed along the pits. The



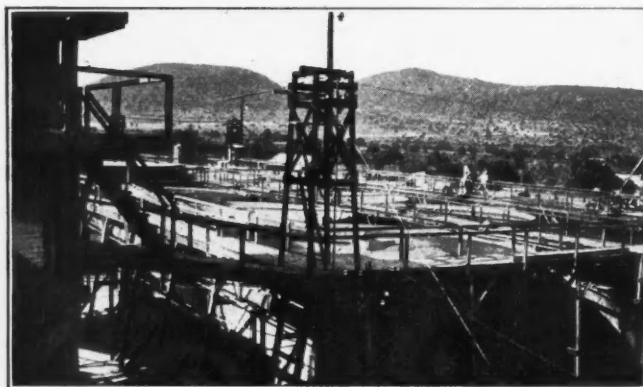
THE PULPER; BLAISDELL COCOSTITLAN SYNDICATE



GENERAL VIEW; PULPERS ON TOWER IN DISTANCE



ADAIR-USHER AGITATOR IN FOREGROUND; BLAISDELL IN DISTANCE



GENERAL VIEW OF CYANIDE TANKS; BLAISDELL SYNDICATE

for treating the ores are rapidly being replaced by the cyanide process. In fact, the cyanide process is now being successfully used to re-treat the tailings made years ago in the older processes.

THE BLAISDELL COCOSTITLAN SYNDICATE

The Blaisdell Coscotitlan Syndicate is the company that is treating the old tailings. At its 350-ton plant below Pachuca, which has been running only a short time, the method for successfully cyaniding this tailing has been solved, and probably the company will soon increase the capacity of the plant.

The country to the west of Pachuca is quite dry, and consequently the *haciendados* owning ranches near Pachuca used the water from the Pachuca river to irri-

sibility of successfully cyaniding this class of material, purchased the rights to treat the tailings of three tracts of land; on these, in four different areas, there is a total of approximately 2,000,000 tons of tailings. These accumulations taper from 7 to 2.5 ft. in depth; it is said that these tailings, of which gold comprises about one-quarter of the value, are worth about \$3.75 per ton with silver at 53c. per oz. As a result of their mode of accumulation these tailings have been water-sorted into slime and sand, separated, of course, by an intervening transition area.

At present the company is treating about 250 tons of tailing a day, but the tonnage will be increased to 350 tons as soon as complete agitation is provided for all of the slimes. At present two Blaisdell

cars are then hauled in trains of 16 cars by a small engine to the bin which is hopper-shaped and arranged with a bottom made of movable cross-slats, so that the ore does not fall directly onto the Robins belt, but can be gradually fed to it. The belt conveyor, passing up an incline, takes the ore to two cylindrical pulpurs, 14 ft. diameter by 2 ft. deep. In these a circular framework, to which are fastened vertical stirrers which disintegrate the clods and vegetal growth (for on the tailing now being treated alfalfa is growing), rotates around a central discharge. The centrifugal force sends the vegetal matter to the circumference where the native attendant skims it off as it accumulates, while the slime overflows at the central discharge.

At first the tailing was pulped with water in this mixer, the whole being passed over Callow screens to remove the vegetal matter, and then the water was separated and cyanide solution added. But this did not give appreciably lower cyanide consumption, nor better extraction than pulping directly in cyanide solution, so it was discontinued and pulping with cyanide solution used. This solution titrates 0.1 per cent. KCN, which is the standard strength of solution used in the treatment. The pulp flows directly to one of the 10 flat-bottomed treatment tanks, 36 ft. diameter and 14 ft. deep, where it is given an agitation-decantation treatment lasting three days, the first agitation continuing 24 hours.

FOUNDATIONS FOR THE TREATMENT TANKS

These treatment tanks rest on a reinforced concrete foundation composed of an 8-in. cylindrical outer wall and an interior filling consisting of sand and gravel, tightly tamped in place. The outer wall is constructed of clean concrete, reinforced by a network of old boiler tubes laced together with barb wire, the wall having a bottom footing 2 ft. wide and 1 ft. thick to give a firm foundation. This was deemed necessary, owing to the fact that all foundations rest directly upon adobe soil. This foundation which was cheaply made, has worked admirably and shows no signs of weakness.

The gold and silver in the solution decanted from the slime tanks are precipitated in nine large zinc boxes. The crude precipitate is melted in steel crucibles holding a 275-lb. charge. These furnaces are fired from outside the bullion room, pinewood being the fuel used at present, but it is planned to burn oil later. The bullion ladled from these fixed steel crucibles is remelted in a small wind-furnace using coke.

The company plans to increase the capacity of the plant to 600 tons per day by adding a 250-ton sand plant. Arrangements are also being made so that in the future the pulp will flow continuously through three tanks agitated by means of rotating arms where the coarser sand, lagging behind owing to its greater specific gravity, will accumulate in the bottom or work more slowly through the system than the lighter slime. After going to classifiers so as to separate the slime, the sand will be sent to sand tanks to be leached while the overflowing slime will go to the slime tanks provided with the movable Blaisdell agitators for future agitation, washing and decantation.

The cyanide consumption at present amounts to about 2 kg. per metric ton of tailing treated, due to the fact that the tailing contains about 0.1 per cent. copper together with organic acids and a small quantity of mineral acids. Both sodium and calcium salts have been tried to neutralize these acids, but they have little effect upon the cyanide consumption. The

precipitation obtained is excellent and at present the total extraction is 75 per cent., but this it is hoped will be increased when more effective agitation is obtained in the treatment tanks.

Relative Corrosion of Steel and Wrought Iron Tubing *

BY HENRY M. HOWE† AND BRADLEY STOUGHTON‡

Is steel, tube steel, intrinsically and incurably materially more corrodible than wrought iron, as unprotected steel and iron are surely far more corrodible than well painted steel and iron? Or is it merely that ill made steel, and steel of unsuitable composition, are more corrodible than well made wrought iron? If the former, then in each and every test which is sufficiently wide to make reasonable allowance for the usual caprices of corrosion, tube steel must necessarily corrode and pit materially more than wrought iron. If the latter, then though in certain tests tube steel may corrode and pit more than wrought iron, either because that steel is ill made or of unsuitable composition, or because of the caprices of corrosion, yet in other tests tube steel should resist corrosion as well or better than wrought iron.

If the latter proves true, then has such a degree of skill in manufacture and inspection been reached that, in each lot of one hundred or one thousand or ten thousand steel tubes delivered, there need be no single tube which shall corrode or pit materially more than the worst tube in a like lot of wrought-iron tubes? Is steel as trustworthy as iron?

To these questions this paper seeks an answer from the evidence at hand, in view of the existing distrust of steel, indeed the general belief that steel is intrinsically and incurably far more corrodible than wrought iron. Where we touch on other questions, we do it to throw light on these.

The day has gone by when this society¹ can hear with patience that, because some steel of unknown source has misbehaved, therefore steel cannot be so made as to behave well. The serious study and great efforts made in the last decade to fit steel tubing to resist corrosion are not to be ignored. To ridicule them would be ridiculous. Have they or have they not yielded regularly a steel which resists corrosion substantially as well as wrought iron?

*From a report which will appear in full in the published proceedings of the American Society for Testing Materials. An abstract of the paper has appeared in some of the technical journals, but Professor Howe has completely recast the present article.

†Professor of metallurgy, Columbia University, New York.

‡Late adjunct professor of metallurgy, Columbia University, New York.

¹American Society for Testing Materials.

What we have to say is based in part on investigations which we have made on behalf of the National Tube Company, and in part on our independent inquiries along lines which suggested themselves to us while we were making those investigations. As we understand, that company is interested in overcoming what it believes to be the existing prejudice against steel tubes.

Our inquiry relates only to uncoated tubes. It does not concern itself with the relative merits of steel and iron for conduits, the life of which depends upon the integrity of their coating.

NO REASON FOR DIFFERENCE IN CORRODIBILITY

There is no reason why steel ought to corrode worse than wrought iron, at least no strong enough reason to call for unusually convincing evidence. The most marked constant difference between them, the presence of cinder in iron and its absence from steel, creates no such reason. In that the particles of cinder themselves resist corrosion they protect the metal beneath. But their distribution is such that this protective effect may be equalled or even outweighed by their opposite effect of hastening corrosion by difference of potential. To increase the mechanical protection by increasing the quantity of cinder should hardly be practicable, at least in case of tubes which need strength, because this would weaken the metal tangentially, i.e., transversely. In cases in which strength may profitably be sacrificed to gain incorrodibility, it may perhaps be practicable to make use of this principle. This might perhaps apply to the metal for certain tanks. The evidence may be summarized as follows:

Steel corrodes and pits less than wrought iron in our own tests lasting seven months, on 12 pieces of steel skelp in competition with 10 pieces of wrought-iron skelp from the best makers, in hot, aerated salt water, a medium previously found extremely unfavorable to steel; in Principal T. N. Thomson's tests on three steel and three iron tubes for about a year in hot water under service conditions; and on simultaneous exposure of many steel and iron pipes to sulphuric acid coal-mine water; in the actual use of 11 steel and 8 iron tubes in railroad interlocking and signal service; in certain locomotive boiler service; and in tests in which 16 pieces of wrought-iron and steel tubing were buried in dampened ashes for 16 months.

Trials in locomotive and in stationary boiler tubing, tended to show that there was no material difference between steel and iron. A 26-month test in the Gayley blast-drying coil at the Isabella furnaces showed no difference between steel and iron; both of which had scaled uniformly.

Five tests were more or less unfavorable to steel. Of these two related not to

modern steel, but to that of 1897 or earlier, and one showed a condition of affairs wholly exceptional; while the evidence in another case is obscure if not self-contradictory, and is not shown to apply to modern steel tubing. In the only test unfavorable to steel which is known to apply in modern steel tubing, on simultaneous exposure, pushed to destruction, to sulphuric acid mine water, the average life of three steel tubes was 11 per cent. less than that of three iron ones in series with them, and the life of the shortest lived steel tube was 14 per cent. less than that of the shortest lived iron tube.

This is all the evidence which we have found and received permission to cite, though we have asked manufacturers prominently and financially interested in showing that steel is worse than iron to give the addresses of those who could give us evidence. None of that which we have found but have not yet received permission to cite is unfavorable to steel.

SIGNIFICANCE OF THE TESTS

To sum this up, tube steel has corroded less than wrought iron in seven distinct sets of tests by seven different sets of observers, in seven different places. In three other sets steel and iron behaved substantially alike. Eight of these ten sets were under conditions of service, and in six of them corrosion was pushed to destruction.

In five cases steel corroded worse than wrought iron, but in the only one of these in which the steel tube is known to be modern, the difference was moderate.

Further in our own tests, steel tubing of 1906 pits very much less than that of 1897 from the same makers.

The fact that steel has behaved as well and often better than wrought iron in so large a number of tests seems to us cogent evidence that steel is not intrinsically materially more corrodible than wrought iron. The fact that in one set, modern tube steel has corroded a little worse than wrought iron does not conflict with this inference in the least.

Opposed to this evidence there is a very widespread and deep distrust of steel tubing, indeed a belief that it habitually pits deeply, and that wrought iron corrodes uniformly, a belief contradicted by the evidence. This distrust, so far as we know, is not based on any direct competitive tests between materials known to be good modern steel and wrought iron respectively; note that we restrict ourselves to known good modern tube steel, made specially to resist corrosion.

Instead, this distrust seems to rest on the results of practical experience.

PERSISTENCE OF THE DISTRUST

Most of this experience cannot have been with good modern steel tubing, but must have been with the older tubing which preceded it. Now, the present sur-

vival of this distrust in spite of the apparent great improvements in making tube steel resistant, and in spite of the evidence that it does resist as well as iron, need not surprise us in the least. Such a survival is always easy. It is especially easy under the unusual conditions of this case, viz., that the user has not been able to tell steel from iron by his own observation, and that in a large proportion of cases tubing sold as wrought iron has actually been steel. We believe that we are right in saying, that, of the three great classes of users, architects, civil engineers, and plumbers, the last only have in general attempted to learn by direct personal observation whether a given tube was steel or iron. This the plumber has thought that he could do with certainty by the threading test; but the evidence shows that this test, at least in most hands, is useless. It is beside the mark to say that he could have distinguished steel from iron by the etching test, because, as we understand, this test has not, in fact, been used to any important extent. With the best intentions steel and iron carried in stock are likely to get mixed up, unless precautions are taken to keep them separate. The fact that neither dealer or user could tell them apart has removed one usual motive for preventing errors.

This actual ignorance of users as to whether any given lot of pipe is steel or iron seems to us of value, not, of course, in showing whether steel or iron is the better, but in interpreting the existing distrust of tube steel in the face of direct cogent evidence tending strongly to show that this distrust is unjust.

The truth must fit all the facts, and no fact can be rejected simply because it does not fit our preconceived belief as to what the truth is. The truth is what the facts, all the facts, show, and not what we may in the past have thought they showed.

No matter how strong we may think the presumption created against tube steel by the very existence of the present distrust, no matter how heavy the burden of proof that we may demand of the defenders of steel, we have no right to shut our eyes to the evidence. Nobody has a right to say either that defects which may in the past have lessened tube steel's resistance cannot be cured by skill and care, or, except on valid evidence, that they have not been cured. The existence of distrust calls for caution, but does not justify incredulity, especially in view of the special conditions of this case.

The theory that steel is intrinsically and incurably more corrodible than wrought iron is contradicted flatly by the evidence given. It therefore must be abandoned, unless resuscitated by correspondingly direct, convincing, and abundant counter-evidence, clearly relating to well made modern tube steel. Nobody doubts that

ill made steel may misbehave. The distrust of steel may be nothing but a survival from a day when it was justified, or it may be only an unjustified inference that, because some steel corrodes badly, all must. The distrust can be explained away; the evidence cannot. Therefore, the evidence and its implications must stand until refuted.

INSPECTION INADEQUATE

Our second question now arises, "Have manufacture and inspection been so perfected that, reproducing continuously the conditions which have made so much of the steel of our present evidence as incorrodible as wrought iron, they may deliver only steel of like incorrodibility?" That they will be so perfected some day we can hardly doubt; but have they been already? To prove this so that the community can rely confidently on it, needs more evidence, especially of cases in which corrosion is pushed to destruction. We understand that such evidence is accumulating rapidly. But though not proved, it is easily made credible, indeed, to our minds on the whole probable (1) by the very fair degree of harmony among the large number of tests of modern steel reported; and (2) by the fact that out of the 22 pieces of modern steel tubing represented in three of our tests, not a single one shows any abnormal pitting, nor behaves materially worse than the worst of its iron competitors, of which those in our own test at least were from the best makers.

Purifying Rock Salt by Fusion

A company called The New Salt Syndicate has been formed in London to refine salt by a new process, by melting and separating the impurities as dross. According to the specifications of the English patent, the rock salt is melted in a horizontal furnace upon a number of trays, preferably in echelon arrangement with large spaces between the shelves. The molten salt is collected either on the bed of the furnace, or in a well directly connected with it. The salt forms a number of heaps, which are uniformly heated by the furnace gases, and as the material melts and flows down the collecting beds, fresh salt is supplied as required through charging doors in the furnace roof. The trays, or carriers, are made of firebrick and are provided with raised edges having openings at suitable points so arranged that the fluid salt flows out while the solid impurities and dross are retained.

A modified form of the furnace has only a single continuous platform, which is slightly inclined to cause drainage of the molten salt to the furnace bed. The floor of the bed inclines so that the heavier impurities gravitate away from the tap-hole. The process is now in operation in England on a large scale.

Costs and Profits on the Witwatersrand

The Methods Which Have Been Severely Criticized Compare Favorably with Those of Other Fields Where Conditions Are Still Unsettled

BY JAMES RALPH FINLAY*

The great gold-mining field, Witwatersrand, produces one-third of the world's annual yield of gold, and is so well known to the mining public and even to the public at large, that any general description of it other than such as will serve my purpose of illustrating the factors governing the cost of mining, is unnecessary.

The occurrence of the ores here bears a resemblance to that of two important districts described elsewhere in these articles, i.e., to the copper conglomerates of Lake Superior and to the Kolar mines in India. Like the Calumet conglomerate the banket beds of the Transvaal are mineralized sedimentary beds, and the value of the material worked is not far from equivalent, but the "Rand" beds are thinner, more persistent and workable over much greater areas. The Kolar mines, while on a vein of different geological origin and producing ores of much higher value, bear a considerable resemblance in the persistence and abundance of the mineralization.

Two recent papers by distinguished American engineers throw excellent light on the present condition of the industry. Ross E. Browne has written an exhaustive discussion of "Working Costs on the Mines of the Witwatersrand," (republished in the *Mining Journal*, of London, in the issues of July, 1907) and Thomas H. Leggett, (*Trans. A. I. M. E.*, February, 1908), describes the "Present Mining Conditions on the Rand."

Mr. Browne sizes up average conditions for the whole district as follows:

	Per Ton Milled.
Working cost	\$5.85
Capital redemption	1.22
Total expense	\$7.07
Yield	8.71
Profit	1.64

By capital redemption, I suppose, Mr. Browne means all capital, including probably large sums paid for mining claims. By the theory of costs used in this article such sums are profits paid to somebody by the working of ore from the land and are not, therefore, costs. Accordingly Mr. Browne's estimate of the cost of capital redemption is somewhat high; but in round numbers we shall not be far wrong if we say that the mines produce \$135,000,000 in gold a year, of which at least 20 per cent., or \$27,000,000 a year, is clear profit after allowing for all proper return of capital employed in operating. In round numbers this return of \$27,000,000

per year represents the value of the mining claims and, capitalizing the earnings at 7 per cent. per annum, we find that the claims might be valued at about \$400,000,000.

On nine representative mines in the district Mr. Browne finds the following average working conditions:

Number of stamps operating	111
Working costs per ton milled	\$5.19
Percentage rejected by sorting (probably at surface only)	13
Ratio of tons developed to tons mined ..	0.90
Width (thickness) of stopes in inches ..	69
Continuity of reefs, normal for the Rand, unrivalled elsewhere	
Average depth of mining in feet	1200
Dip of reef	30 deg.
Hardness of ground, solid quartzite and slate ..	
Cost of timber per ton of ore mined	4c.
Cost of coal per ton delivered at plant	\$3.41
Gallons of water pumped from mine per ton of ore milled	313
Duty of stamp, tons milled per 24 hours ..	4.85

With the above average conditions the average costs are as follows:

Development cost per ton	\$0.37
Other mining costs	2.63
Total cost per ton hoisted	\$3.00
Milling, crushing and amalgamating	0.69
Cyaniding	0.64
General expense at mines	0.25
General expense at head office	0.18
Total	\$4.76

These figures represent the costs as they would be if all the ore hoisted were milled, but as 13 per cent. is rejected by sorting, the cost as divided by the tonnage actually milled is brought up to \$5.19.

A COMPARISON OF RECORDS

I cannot believe that these figures make a disadvantageous comparison with costs of similar operations elsewhere. This opinion is somewhat at variance with the general idea among mining men, and, as I have never been in South Africa, it is perhaps well to explain that I am going wholly upon the consideration of the basic principles involved.

Mr. Browne sees hope of reducing costs to about \$3.75 per ton by increasing the efficiency of white labor, by better direction of colored labor and by reducing the cost of supplies. With this hope I certainly have no quarrel and it is probably not altogether extravagant. Considerable improvements are brought about by necessity and by long continued effort. As the grade of ore diminishes the cost is inevitably diminished by the simple process, among other things, of refusing to work ores that present difficulties beyond a certain limit. But as a matter of practical experience, taking into consideration all the ins and outs, good luck and bad accidents, it seems to me that the performance of the Rand mines is fully as good as that of other mines.

To judge better of this let us look up the life history of the greatest of the Transvaal mines, the Robinson, and see how it compares with other great mines of which we have the records.

ROBINSON GOLD MINING COMPANY, TO END OF 1906.

Tons milled	2,657,768
Total value \$46,535,000	per ton, \$17.50
Working cost per ton	6.36
Construction and improvements	0.78
Total cost per ton milled	7.14
Profit \$27,680,000	per ton, 10.36
Dividends and cash in profit and loss ..	24,219,000
Real estate, securities and cash on loan	3,461,000

Nearly 60 per cent. of the entire gross revenue is shown as clear profit. Few mines of this grade can equal this showing of costs.

It would be an exceedingly laborious compilation to get the average costs in detail, so I shall content myself with giving the details in a year of which the costs approximate the average. Such a year is 1897 when the total cost was \$6.90 divided between working cost at \$6.25 and construction at \$0.25. In this year the tonnage hoisted was 203,597 of which 23,197 was sorted out on the surface. In addition the amount sorted out underground was estimated at 60,000 tons making the total stoped about 263,500 tons. Since the sorting out of this waste underground serves no useful purpose in protecting the safety of the workings, it was sorted out entirely to avoid the expense of milling. It is probable that the sorting on the surface and stowing of waste underground cost fully as much as the tramping of ore for the mill. For comparing the work done here with certain other mines it is necessary to make these corrections.

MINING COSTS, ROBINSON GOLD MINING COMPANY.

Tons.		Per Ton.
263,500 stoped	\$443,694	\$1.68
263,500 trammed	21,882	0.08
203,597 hoisted	19,671	0.10
263,500 mine maintenance and pumping	47,306	0.18
320,000 developed	178,334	0.56
		\$2.60

These figures are as low as those of the Portland mine at Cripple Creek, figured on the same basis; they are not far above those of the Tamarack, or the Calumet & Hecla, where the volume of material in the same area is more than double, and lower than equivalent work in the Mysore mine. It is to be remembered that the mining is done at the Robinson on two beds, the Main Reef Leader of a payable width of 18 in. and the South Reef of a payable width of 42 in., on which there is not room for working. The effort is to carry the stopes as narrow as possible.

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MILLING COSTS.

	Tons.	Total.	Per Ton.
Crushing and sorting...	203,597	\$18,134	\$0.09
Transport to mill.....	180,400	5,465	0.03
Milling and maintenance.....		78,548	0.43
Power.....		40,094	0.22
			\$0.77

SECONDARY TREATMENT.

Vanning, concentration.....		14,966	\$0.07
Cyaniding, chlorination.....		126,470	0.70
			\$0.77
Total treatment.....			1.54

Here we have ore worth \$20 a ton treated with an extraction of 89.3 per cent. at a cost that seems low enough. A certain correspondence obtains between the value of ore treated and the cost of treatment, even by the same process. To illustrate this take the various Kolar mines for 1899 (I choose that date as being near the period in question here).

	Value.	Cost per Ton.
Ooregum, 1902, 106,000 tons.....	\$15,00	\$1.80
Nundydroog, 1899.....	22.70	2.19
Champion Reef, 1899.....	29.50	3.08
Mysore, 1899.....	31.00	2.00
Balaghat, 1899.....	12.40	1.90

Here it is seen that with the single exception of the Mysore, which probably had a better equipment than the others, the cost is nearly in proportion to the value. It is also plain that in all cases the Kolar costs were much higher than at the Robinson. Later, of course, they have been greatly reduced.

ROBINSON, GENERAL EXPENSE, 263,500 TONS.

	Total.	Per Ton.
General maintenance.....	\$21,071	\$0.08
General charges.....	73,918	0.28
Machinery, plant and buildings.....	95,716	0.36
Special charges.....	23,531	0.09
Construction.....	46,038	0.18
		\$0.99

If all the rock broken, therefore, were treated, we should find the following comparison with the costs as given:

	Per Ton Milled (as given).	Per Ton Mined.
Mining.....	\$3.90	\$2.60
Treatment.....	1.57	1.54
General expense.....	1.18	0.81
Construction.....	0.25	0.18
	\$6.90	\$5.13

The gradual diminution both of costs and the grade of ore is shown as follows:

	Yield per Ton.	Working Costs per Ton.
1890.....	\$46.20	\$10.02
1906.....	13.84	5.30

At the end of 1906, 2,180,000 tons of ore were blocked out, of which the development had been paid for by mining operations to date. The average assay value of the reserves was \$14.50 per ton, and the extraction being realized was 93 per cent.; so that a net yield of \$13.50 can be expected. It seems plain from the steady reduction of costs that these reserves can be mined for all working and construction costs for \$5 a ton, leaving a net profit of \$8.50 per ton, or \$18,500,000.

NOT A RECORD OF EXTRAVAGANCE AND CARELESSNESS

I feel that this record of the Robinson mine shows, in a general way, the achievements and tendencies of the Rand industry; and that it is a monument, not of extravagance and carelessness, but of excellent engineering and of broad-gaged and honest management.

With this view of the cost problem on the Rand, Thomas H. Leggett is in full accord. I quote from his paper on the "Present Mining Conditions on the Rand," as follows:

"As a mining camp grows older the working costs almost invariably decrease, providing the camp maintains a healthful activity with advancing years, and this has been the case on the Witwatersrand, the result being as follows:

1898, average working-costs of 65 companies.....	25s. 1.3d.
1899, average working-costs of 42a companies.....	25s. 2.7d.
1906, average working-costs of 58 companies.....	22s. 1.0d.
1907, average working-costs of 56b companies.....	20s. 8.0d.
a The Boer war broke out in October, hence the records are incomplete.	
b Two less than in 1906, due to exhaustion of the Bonanza mine and incomplete records from one other mine.	

"These costs include mining, development, crushing and sorting, milling, cyaniding, maintenance and general expense, but they do not cover depreciation and amortization, these items being more properly dealt with by the directors at the end of the year. These results show the very material decrease of 4s. 6d. per ton since 1899, and are, therefore, approaching now to the 6s. reduction predicted by John Hays Hammond in 1901, but it has taken time to attain this result, as I then pointed out it would do. A comparison of the costs in 1907 with those of 1906 shows a decrease of 1s. 5d., or 34c. per ton, due chiefly to decreased wages and increased efficiency of both white and colored labor, including the Chinese in the latter category, though increased crushing capacity through the use of heavier stamps (up to 1670 lb. per stamp) and regrinding in tube mills have also aided.

"In 1906 fifty-eight companies mined and milled 13,065,624 tons of ore at a total cost of £14,411,219, while in 1907, fifty-six companies mined and milled 14,861,234 tons at a total cost of £15,351,749, being an increase of 1,795,610 tons for an increased cost of only £940,530.

"Most of these economies were attained during the latter half of 1907, after the white miners' strike, and some mines made startling reductions, as, for instance, the Robinson, which reported costs of 14s. 9d. for November, and the Glencairn, of 15s. 1d. per ton.

"Such strenuous and successful efforts are now being made to reduce still more the working costs on the Rand, that I think it safe to anticipate another large decrease for the year 1908."

LABOR COST NOT EXCESSIVE

I have expressed the opinion that costs on the Rand are not essentially different from those that would be obtained were the properties situated in the United States. What about wages? The only direct information I have is the statement of Mr. Browne that whites average \$4.60 a day and colored laborers \$0.66 per day, and are employed in the proportion of 9.2 colored men to one white man.

Average wages about \$1.18 per day; as the percentage of colored men varies, so the average wages will vary from time to time.

In my judgment the figures demonstrate that the Rand is another proof of the fact that the rate of wages does not determine the cost of labor. Criticism of the Rand has been to the effect that costs are higher there than in the United States. Mr. Browne believes that California labor paid California prices on the Rand would be cheaper than the labor actually employed by about 15 per cent. In California wages are approximately \$3 per day. I have estimated average development costs at various places as follows:

	Per Foot.
Rand, average for shafts, drifts, raises, etc	\$20
Kolar, average for shafts, drifts, raises, etc	22
Cripple Creek, average for shafts, drifts, raises, etc.....	14

WAGES.

	Per Day.
Rand.....	\$1.18
Kolar.....	0.36
Cripple Creek.....	3.40

An exact comparison cannot be made, because the rocks and conditions are different. In the Rand the rock is harder than at Cripple Creek, and the openings probably average larger, but on the other hand, there is less water to pump.

EFFICIENCY OF LABOR A FUNCTION OF THE COST

The point I am seeking especially to bring out is that criticism has been applied to the inefficiency of Rand labor as if it were a special case, and that because wages average low on the Rand costs ought to be correspondingly low. I contend that this assumption, if carried beyond certain narrow limits, is an incorrect one, and if established it would be in opposition to a general economic law.

President Roosevelt's great work has often been called a re-affirmation of the Decalogue. I am afraid that the conclusions I have arrived at are of the same class. You will remember the scriptural phrase, "The laborer is worthy of his hire," and the common proverb that the "Workman is known by his tools." These statements contain the essence of the problem of the cost of labor, always the fundamental and final element in the cost of anything. The gist of the whole subject was tersely stated by the first Lord Brassey, the great English contractor, who said that the same work costs the same money

anywhere regardless of the price of wages. The workman, the tools and the wages go hand in hand. Good wages command through competition, effective workers. Good workmen create efficient tools.

On the other hand, it is a truism to say that high-class tools and machinery can only be used by men who have intelligence enough to secure the wages their efficiency justifies. Where a man's idea of moving dirt is to fill a basket with his hands and carry the basket on his head, his wages correspond with the fruitfulness of his idea; he earns 10c. a day. Where dirt is moved by the complex organism of modern civilized industry which applies external power through the agency of railroads and steam shovels, the men who operate the tools are better paid. The master of the industrial enterprise, which may be described as the greatest tool of all, a mechanism fashioned by the combined efforts of countless brains to direct the united efforts of men and energy to useful work, is pretty sure to be a millionaire; the man who runs the steam shovel gets \$5 a day; the laborer who moves the ties in front of the steam shovel gets \$2 a day. In the world's market the product is worth the same thing whether it is the result of an industrial miracle or of infinite but stupid human labor. When mankind produces efficiency it gets a due return for it, a return which is expressed pretty accurately in wages.

A RULE WITHOUT EXCEPTIONS

The only reason why these conclusions are not accepted as truisms is that people are suspicious of each other and are accustomed to doubt the fairness of the distribution of wealth. That this distribution is a matter, the fairness of which can only be guaranteed by ceaseless vigilance, it is a folly to doubt; but, on the whole, I believe everybody concerned *does* exert vigilance, a vigilance made instinctive by the fundamental laws of the evolution of life, and on the whole the distribution is pretty fair. To avoid possible errors, however, we had best perhaps not apply this generalization to work of an ephemeral character, but only to permanent or semi-permanent industries where labor has time to adjust itself to competition.

But here we have to meet the question, are not modern methods employed in South Africa and India? Have we not sent there our best engineers, our most modern machinery and our best methods? If so, then why are not the men more efficient and the wages higher? I answer that it is indeed true that we have sent many civilized appliances to those places, but not all. Among the things we have not sent are the surroundings, point of view, ambition and energy of a civilized community. The few hundred or few thousand Europeans who operate mines in Africa or India are immersed in an ocean of black humanity upon which the small foreign community has an influence,

true enough, but not such an influence as to revolutionize the habits, aims and expectations of the natives.

An enterprise so situated must take into account at the beginning the state of mind of its future employees, and it would be silly to make such plans as might run counter to their prejudices; and, even if the managers had hopes of making the natives eventually as effective as Europeans, he would have to plan his operations on a different basis. As a matter of fact, such an expectation is hopeless; an individual Kafir or Hindoo may fill a certain position as effectively as an European, but to expect a large body of such people to become collectively as effective as a body of Europeans whose ideas had been trained for generations along lines making for an entirely different standard of effort, is quite absurd. A considerable body of whites may indeed supply a certain amount of mental and nervous energy to the natives which the latter could not supply for themselves, but in so doing the white men must use up energy in the direction of others that they might otherwise use in their own labors.

If a body of colored men in a colored man's country is going to turn out work under the direction of white men as cheaply as the white men can do it themselves in their own country, they must do it by working for lower wages. This is exactly what happens in every case. It is a rule to which there are no exceptions.

Alloys of Gold and Tellurium

Certain alloys of gold and tellurium have been examined by T. K. Rose.¹ Mixtures of gold and tellurium were prepared by melting tellurium, or a tellurium-gold alloy, in a clay crucible under charcoal and adding a weighed quantity of gold. The mixture was well stirred, a thermocouple inserted, and the crucible cooled without further disturbance. After solidification the crucible was broken and samples of the alloy taken for assay and examination with the microscope.

It was found that the presence of 0.05 per cent. tellurium in gold reduces its resistance to shock, making it somewhat fragile, and when more tellurium is present the alloys are very brittle. The microscope shows these alloys to consist of crystals of gold set in a greyish white eutectic alloy. As the percentage of gold falls to 60.7 per cent., the eutectic alloy increases at the expense of the metallic gold, until the latter vanishes entirely.

Gold containing 2.4 per cent. tellurium is of a pale brass yellow color when not magnified. As the tellurium increases, the color of unmagnified specimens becomes more pale. The eutectic alloy itself, which contains 60 per cent. gold,

still has a faint yellowish tinge, but the compound $AuTe_2$, which contains 43.59 per cent. gold, is white or gray, without any tinge of yellow.

Between the alloys containing 60 per cent. and 20 per cent. gold, the compound $AuTe_2$ (gold 43.59 per cent.) separates out on cooling, leaving either the gold-rich eutectic, (60 per cent. gold), or the gold-poor eutectic, (20 per cent. gold), to subsequently solidify.

The compound $AuTe_2$ is well known to exist in nature as the minerals calaverite and sylvanite, in which part of the gold is replaced by silver. By the examination of fused mixtures of gold and tellurium, no evidence is obtained of the existence of compounds corresponding to the minerals petzite (Ag_2Te with some of the silver replaced by gold), coolgardite (M_2Te_3 , in which various replacements occur), or kalgoorlite (M_3Te_2 , or M_3Te_3).

The behavior of tellurides of gold on roasting is partly explained by the remarkably low temperatures of fusion observed in the experiments, all mixtures containing less than 60 per cent. of gold being completely fused before a red heat is reached. The production of spherical globules of gold must, therefore, accompany the roasting of gold ores containing tellurides, however carefully the operation may be carried out. Such globules will not be free from tellurium.

The main conclusions derived from a study of the results of the experiments are summarized by the author as follows:

(1) A compound, $AuTe_2$, or Au_2Te_3 , containing 43.59 per cent. of gold and corresponding in composition to sylvanite or calaverite, is formed when tellurium and gold are melted together in certain proportions. This compound fuses at a temperature of 452 deg. Centigrade.

(2) Two eutectic mixtures are formed, containing 60 per cent. and 20 per cent. of gold, respectively. These alloys correspond in composition to the formulas $AuTe$ and $AuTe_2$. Under the microscope they do not show the characteristic banded eutectic structure, but there are no certain indications that they are true compounds.

(3) All the alloys of gold and tellurium are brittle.

(4) All alloys of gold and tellurium, which contain less than 60 per cent. of gold, fuse at temperatures between 397 and 452 deg. Centigrade.

As a general rule, writes an authority on copper and brass, the lower the temperature at which copper is rolled and annealed, the tougher and better is the manufactured product. Also, the thinner the manufactured article, the lower must be the temperature of working.

In West Australia it is found that the grab sampling of ore as it is drawn into the cars from the chutes agrees closely with automatic sampling at the mill.

¹Paper read before the Inst. Min. and Met., Feb., 1908.

The Use of Natural Gas in the Joplin District

Methods of Utilizing Gaseous Fuel in Boiler Plants and the Relative Economy of the Steam Engine and the Internal Combustion Motor

BY DOSS BRITAIN*

The natural gas used in the Joplin district is pumped from Liberty, Kansas, through the "Southern Trunk," a 16-in. pipe line 65 miles long, from which it is delivered to the mills and to local gas companies at the city limits. It is estimated that 20,000,000 cu.ft. per day are consumed in the district, 25 per cent. of which is used for manufacturing and domestic purposes and the remaining 75 per cent. in the concentrating plants of the lead and zinc mines. Approximately 400 companies and individual operators use natural gas. For use under boilers it is delivered at a regular summer rate of 10c. per 1000 cu.ft. and 12½c. per 1000 cu.ft. in winter. For gas engines the rate is 25c. the year round. Since the introduction of gas into the district in 1905 the service has been very satisfactory, no shut-down longer than a day having occurred.

Although there is a slight variation in the composition of natural gas furnished by the Jasper County Light and Fuel Company, which supplies the district, its average is approximately as follows: Carbon dioxide, 0.45 per cent.; ethylene, 0.35; carbon monoxide, 0.41; marsh gas, 93.35; nitrogen, 3.41; oxygen, 0.39; hydrogen, 1.64 per cent.

For mining purposes natural gas is used in two ways: under boilers, the most common way, and in gas engines. Under boilers the advantages of natural gas, as compared with coal, are cleanliness, ease of operation and regularity of supply and heat, which gives a steady power to the machinery and reduces repair bills to a minimum. The regularity of supply eliminates all loss and inconvenience resulting from coal strikes. In efficiency, laboratory experiments at the University of Kansas indicate that in water-evaporating power, one ton of soft coal is about equal to 20,000 cu.ft. of natural gas.

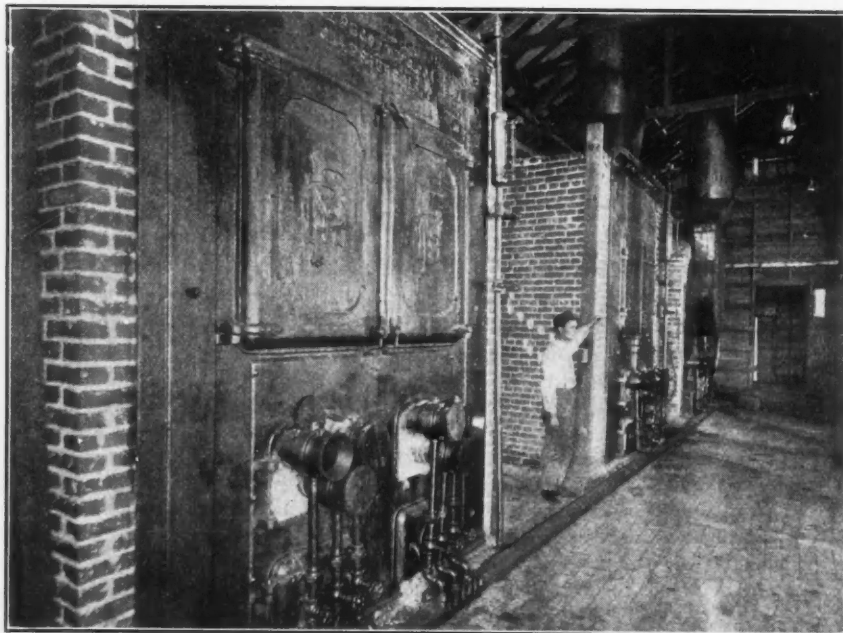
To determine the number of B.t.u. per cubic foot of natural gas, experiment shows the following formula applicable for all practical purposes: B.t.u. = per cent. hydrocarbons × specific gravity of gas × 18.3.

The products of combustion of gaseous hydrocarbons, the chief constituent of natural gas, vary with the amount of oxygen available for combustion. If the supply is insufficient the carbon forms, with oxygen, carbon monoxide, with resultant loss of more than half the heat

units in the carbon. With a still smaller supply of oxygen the hydrogen, with oxygen, forms steam, and the carbon is deposited as soot with more loss of heat units. For proper combustion of one cubic foot of natural gas two cubic feet of oxygen are required. Since in the use of gas under boilers the source of oxygen is the air containing 21 per cent. by volume of oxygen and 79 per cent. nitrogen, about five cubic feet of air is necessary to supply one cubic foot of oxygen, or ten cu.ft. of air for every cubic foot of gas. In actual practice, however, it has been found advisable to use from 11 to 13

matter to construct a burner that, under uniformity of draft, pressure, etc., will give satisfactory results, the construction of one that operates satisfactorily with these conditions continually varying is another matter. In the Joplin district four types of mixer burners have found general favor: the Roberts, Kirkwood, Gwynn and Equitable.

In the Roberts burner the gas is taken in at the side, and from a chamber surrounding a hollow cone is permitted to escape into the mixing chamber through the orifice between the small end of the cone and the shell of the burner, the flow



BOILER PLANT FITTED WITH NATURAL-GAS BURNERS

parts of air to one of gas. The heating equivalent of Kansas natural gas is about 990 B.t.u., and its economy depends on the completeness of the combustion. Although 45 cu.ft. of gas per boiler horsepower hour should be the maximum consumption, few equipments consume less than 60 cu.ft. per horsepower hour.

NATURAL GAS AS BOILER FUEL

Efficiency in the use of natural gas under boilers depends on the kind of burner used, the care employed in designing the installation, and on intelligent attention and regulation. Gas was first burned from the open end of the supply pipe; this was followed by the mixer type of burner, and of these a legion have appeared. While it is an easy

being regulated by adjusting the cone, enlarging or contracting the orifice. Air is taken through the cone as well as through the air ports. By means of a draft through the cone this burner will, in a manner, siphon the gas into the furnace, a very low pressure being needed from the gas itself. The burner is placed in the fire door of the boiler or furnace, one in each door. The largest size is 36 in. long, 9 in. in diameter, has a 3-in. gas inlet, and yields 125 h.p. The second size is 30 in. long, 8 in. in diameter, has a 2-in. gas inlet, and produces 60 h.p. under ordinary pressure.

The Kirkwood burner consists of an outer and an inner casing, forming a circular space into which a large number of small pipes having fine holes or jets are

*Joplin, Missouri.

introduced, and a nozzle. The gas is introduced into the circular space through an opening provided for that purpose and passes thence into the small straight pipes arranged spirally in the body of the burner. From these it emerges through small openings in a myriad of fine jets and mixes with the air, which is drawn into the burner. The spiral arrangement of the pipes breaks up the air and introduces the gas into it with a swirling motion. This burner works most efficiently with a gas pressure of from 2 to 8 oz., each burner evaporating the equivalent of 25 h.p. with a 2-oz. gas pressure. With a gas pressure of 6 to 8 oz. each burner will evaporate 35 h.p., if the stack draft is sufficient.

When more than two burners are installed under one boiler a single valve on each burner is sufficient, for when three or more burners are used, the boiler may

contents of the mixing chamber are thrown into spiral or rotary motion by the manner in which the gas enters. Should the gas pressure be very low, means are provided for the production of steam or compressed air jets into the mixing chamber, whereby the air and gas may be kept at the proper velocity to insure perfect mixture. The Gwynn burner is made in three sizes, with capacities of 25 h.p., of 8 h.p. and 4 h.p., respectively.

APPLICATION TO BOILER PLANTS

In preparing a boiler plant for gas fuel the entire grate surface is covered with firebrick and clay, sand, or any material that will withstand the heat and keep the grates tight. A 4-in. brick wall is built in the door of the boiler or furnace with a 6-in. square opening for the burner, which should extend through to the inner edge of the wall. In no case should the

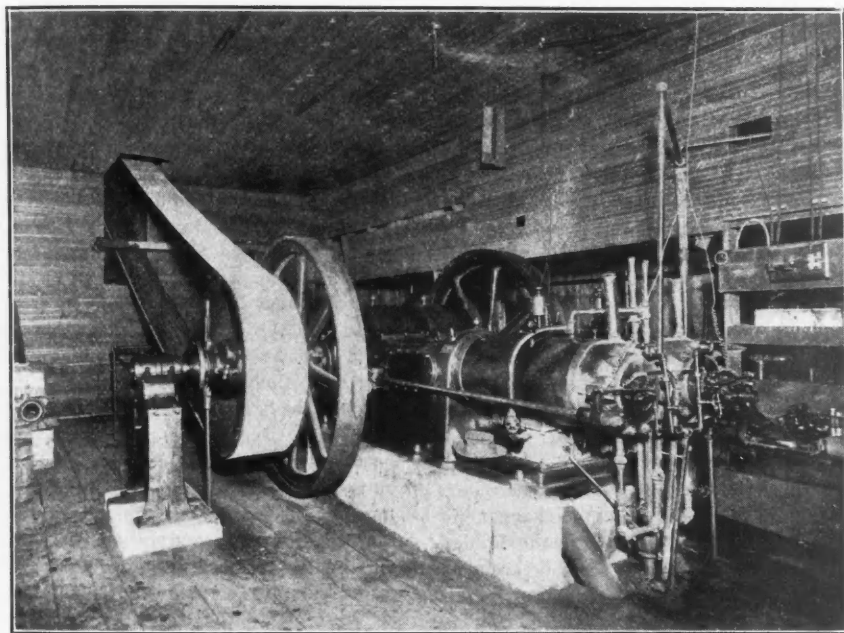
to the combined areas of all the supply connections. A control valve should be used with each burner, so that any combination of burners can be used without interfering with the balance. The air regulator should be closed when the burner is not in use to prevent a rush of cold air to the firebox. Good draft should always be maintained, and if the boiler is working at its rating, or above, the damper should be left open; there are not many cases in which the draft is too strong to burn the gas properly.

The Equitable burner consists of an outer tube forming the main portion of the burner, and tapering slightly from the outer end to the point where the combustion occurs. Around the rear of the outer end of this tube is an annular chamber to which the gas is admitted from the top or bottom, or both. Opening from the gas chamber to the inside of the tube is an annular slot, and within the outer tube is an inner tube ground to fit, and having a series of longitudinal slots of three different lengths; wherever these slots intersect with the annular slot opening into the gas chamber, gas is permitted to flow into the inner tube. As the slots are of varying lengths the amount of gas can be regulated by an adjustment of the inner tube. Inside the tube and in front of the openings for gas is placed a small cone against which the gas impinges, causing it to mix more intimately with the air.

Whatever type of burner is used it should be watched closely, for a slight variation in conditions will necessitate adjustment. The fireman can soon determine with his eye the most satisfactory flame, and by a simple turn of the wrist can save money for his employer. The firebox should be large and the burner so set as to distribute the flame as evenly as possible. All blow-pipe effects against the shell or tubes of the boiler should be avoided. Stack temperatures should be kept as low as possible, and all leaping tongues of flame should be reduced to a clear even incandescence. The inside of the firebox should be whitewashed so as to disclose at once any deposit of soot or smoke, which is a certain indication that the fire is wrong. Patience is necessary for good results, and since no installation operates exactly as any other, experiment is the only means of determining the proper method of obtaining correct combustion. Gas is so easily applied as fuel that there is a tendency to overwork the boilers, which is a reprehensible practice, although with natural gas boilers will stand a third more overload than with coal.

NATURAL GAS IN GAS ENGINES

The use of natural gas in gas engines in the Joplin district is rapidly becoming more prevalent, an estimate placing the aggregate capacity now in use as motive power in the mills at 8000 h.p. Notwithstanding the proved efficiency and econ-



TYPICAL GAS-ENGINE INSTALLATION IN A JOPLIN MILL.

be operated efficiently at various loads by shutting off one or more of the burners, allowing the operating burners to work at or near their ultimate capacity, at which point they are most efficient and economical. Additional valves on boilers of 100 h.p. and under are useless, for they are never used in actual practice for regulation and serve only to multiply the parts unnecessarily. Because of variations in stack draft and gas pressure, an air damper is placed at the back of each burner for regulating the amount of air admitted.

In the Gwynn burner the gas is admitted to the mixing chamber through numerous circumferentially arranged rows of openings, each row having openings of different sizes controlled by a valve, the object being to vary the quantity of gas admitted to the mixing chamber without changing the velocity of the jets. The

burner be built in tight; a current of air must pass around the outside to protect the end of the burner from the intense heat. A checker wall of firebrick is built across the firebox at right angles to the burners. In short fireboxes the checker wall is not required, the bridge wall in the rear being sufficient. The checker wall should be built of open work, and when the firebox is more than 4 ft. wide, it should be double at the bottom and taper to the top; in any case it should extend to within 6 in. of the bottom of the boiler. The burners should be distributed across the front of the boiler to give as nearly as possible an even distribution of heat. In no case should the supply pipe be smaller than the size for which the burners are designed. If there are several burners, a large header should be used across the front of the boiler, the area of the header being equal

omy of the gas engine, it has been slow to supplant the steam installations, for several reasons among which are the following:

(1) Ignorance of the possibilities and economies of the gas engine; (2) the possession of fairly efficient steam plants by most power users; (3) doubt as to the reliability of gas engines and prejudice against them arising out of experiences with gasolene engines. The gas engine, however, is rapidly increasing in favor and it is predicted that within a few years there will be a larger number of high-grade gas engines operating in the district than in any other equal area in the world.

Gas engines are divided into two classes, the two-cycle and the four-cycle types; about 90 per cent. of the engines now being built are of the four-cycle type. The essential difference between the two types is that in the two-cycle engine there is an explosion every revolution, while in the case of the four-cycle type an explosion occurs every two revolutions. The two-cycle engine runs more smoothly, but is from 25 to 50 per cent. less economical and is shorter lived. The type commonly used in the Joplin district is of the standard four-cycle type.

The advantage of the gas engine, as compared with the steam installation lies in its low cost of maintenance, the small amount of attention required, its efficiency and economy. With a first-class gas engine the operator is relieved of the numerous troubles incident to the operation of a steam plant, such as frozen or leaky piping, leaky and burned-out boiler tubes, boiler scale, etc. The attention required by a gas engine is usually only about half that given a steam engine, and the smaller sizes are run without an engineer. In one case a 100-h.p. gas engine was run 23½ hours per day and required only two hours of an 18-year-old boy's time to keep it in perfect order. There is a difference of opinion as to the saving in wages made possible by the substitution of gas engines for steam; some maintain that for the same capacity gas engines require more expensive attendance than steam.

In efficiency the advantage lies decidedly in favor of the gas engine. After one hundred years of experiment and investigation, the modern steam plant, as now operated with all fuel-saving devices, high-pressure water-tube boilers, economizers, superheaters, compound condensing engines, etc., requires at least 25,000 B.t.u. to produce one horsepower hour. This result is obtained by burning about 2 lb. of coal and involves a total efficiency of only 10 per cent. Producer-gas plants with internal-combustion engines have been able to increase the efficiency to 16½ per cent., producing one horsepower hour with 15,600 B.t.u., or 1.25 lb. of coal.

With Kansas natural gas a good gas engine will produce one horsepower hour with an expenditure of 10.5 cu.ft. of gas

containing 10,000 B.t.u., or an efficiency of 25.5 per cent., which, it will be observed, is more than twice that of very modern steam plants using coal as fuel, and far superior to those of the average Joplin mill. With gas at \$0.25 per thousand, the rate at which it is furnished for gas engines, and with a high-grade gas engine producing one horsepower hour with 10.5 cu.ft. of gas, power would cost \$0.002625 per horsepower hour, while with the most modern steam power plant using coal at \$2 per ton, delivered at the mill, power would cost \$0.0035 per horsepower hour. The gas-engine companies guarantee power in the district, all expenses taken into consideration, at \$0.003 per horsepower hour.

Short Talks on Mining Law—XI

By A. H. RICKETTS*

An easement is a permanent interest in the public domain, as a right of way for the maintenance of ditches or canals, or, in the mining claim of another, as the exercise of the extralateral right, or, in the lands of another, as the right to ditches and canals which vested or accrued in a mining claimant before patent issues to the claimant of other parts of the public lands, or subsequent to the grant and before the issuance of a patent to a land-grant-aided railroad for lands within the limits of its grant. The land to which the right or privilege, as it is sometimes termed, is attached, is called the *dominant tenement* and that upon which it is imposed, the *servient tenement*. The servient owner cannot change his tenement to the prejudice of the holder of the dominant tenement. The easement is coupled with the right to enter and enjoy it at all times, in such manner as to impose as slight a burden upon the servient tenement as practicable. Its improper use or its unauthorized enlargement, or a change in the manner of its use, as from a ditch to a pipe line, may be enjoined. An easement may be acquired by virtue of a statute, grant, reservation or exception, lease, agreement, tacit consent, implication, prescription, as by the digging of a well upon public land for the collection of percolating waters or by adverse use for the period and by the performance of the acts required by the local statute of limitations. It may be assigned, released, abandoned or merged, as by the union of ownership of the two tenements. It is not the subject of patent nor of adverse proceedings in an application therefor.

DRAINAGE AND OTHER EASEMENTS

Drainage and other means to the complete development of a mining claim but

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not for discovery purposes, a right of way for the construction of ditches and canals, are instances of easements in connection with mining claims. Drainage is a term applied to the means by which a mining claim is freed of its superfluous water. A ditch may be necessary for drainage, that is, to carry off superfluous water from a lode or drift-mining claim, or on the other hand, to convey water to an hydraulic or other placer or possibly a lode-mining claim. In either case, it may be a means to a "complete development of the property." It has been held that the construction of a flume to carry away waste from a mine is not development work in the sense of annual or assessment work thereon. Drift mining, in legal nomenclature, is a method of mining the channels of extinct rivers covered in some instances to a depth of several hundred feet by lava or other matter.

The right to a ditch may arise as appurtenant to a mining claim or to a water right as a means for the transportation of water for some other beneficial purpose from the point of diversion to that of intended use. In the former case it may be or may have been initiated under the mining act, and in the latter under a local statute, or possibly both, or by adverse possessions. Congress early (1866) recognized and provided for the confirmation, as well as the establishment of water rights, and also for the payment of damages to any settler on the public domain for the damage or injury incurred by the exercise of such right. The test of the right may be said to be the priority of possession. Any patent issued by the land department must fully express all conditions imposed by the local legislation, if any, for the working of mines involving easements, drainage and other necessary means for the complete development thereof, and contain a provision that it is issued subject to the vested and accrued rights thereto in others, as provided by the mining act. It does not follow that the date of the patent is conclusive of the question of priority. For instance, a mining patent relates back to the location upon which it was based, but not to a location of the ground described in the patent, which may have been previously made and which does not appear as part of the application for patent.

LICENSES

A license as it affects real property is a privilege or permit to do a particular act or, probably, a series of acts, upon the estate of another, which otherwise would be unlawful, as the deposit of waste or water upon or the erection of a flume or tramway thereon, or the running of a tunnel therein or having access to the working of one claim through the workings of another, or the taking of mineral from another's mine. No title is conferred by a license unless granted in perpetuity for a specific purpose coupled

with an interest necessary for its enjoyment and use, in which event it is practically an easement.

A license may be written or verbal, express or implied; it may at will, expire by limitation, or be made perpetual. Generally, it may be revoked at any time, although based upon a consideration, but damages incurred by its withdrawal, even when revocable, may be recovered by the licensee if prejudicial to other rights in him. Sometimes a license to occupy a part or parts of the surface of a mining claim is granted to others for domestic or trade purposes. It then partakes of the nature of a lease and the possession of the licensee is presumed in law to be the possession of the licensor.

LEASES

A lease is a written or verbal contract for the possession and use of real property or of a part or parts thereof for a definite time, or at will, for a stated consideration called rent, royalty or tribute, payable at fixed times in money, or in a part of the product or an agreed percentage of the proceeds or profits thereof, generally in gross. If net, the recital of the items which may be charged by the lessee against the gross, as the cost of extraction, reduction, etc., will avoid possible future complications between the parties. The party taking a lease is variously termed a grantee, lessee, tributor, or chlorider, according, in some instances, to whether the rent is paid in money at all events, or payment is dependable on contingencies of productions, and in some cases to geographical position.

Each mining lease has its own peculiar details and may be forfeited for a breach thereof or the forfeiture may be waived or be modified, rescinded, cancelled or abandoned. It is usually most strongly construed against the lessee, because of the nature of the property leased, particularly in the case of petroleum placer mining claims. Time is of the essence of the lease whether so expressly stated or not, as in mining leases the lessee should proceed with the utmost diligence in proceeding thereunder particularly when the rent is payable in kind.

What is called a lease by the parties thereto may not in law have that effect; as, when it is provided that the lessor shall have a certain part of the proceeds of the mineral extracted as a return for the permission for working the property, it is in effect not a lease, but a contract of labor to be performed to be paid for by a share of the profits realized from such labor. The parties to such an instrument become tenants in common (but not mining partners) in the product when extracted.

The "product" is the mineral extracted. Profit is the amount beyond the cost of production, that is, the gain which is made upon the investment when both receipts and payments are taken into

account. A paying mine, is one in which there is an excess in value, however small, over the expense of production, although the work may ultimately result in loss, or where there is a small net profit upon the capital invested, although the latter may exceed the accumulated net profits for many years. The receipts, after deducting current expenses, are equivalent to net receipts.

The term mine, as used in a town-site act, means a paying mine, or one which there is good reason to believe exists. The term mine, as used in the mining act is synonymous with the term vein or lode, or other valuable mineral deposit, or claim or location.

OPTIONS

An option is the granting of choice or election to purchase a certain property within a certain time at an agreed price, payable at a certain time or times. If the consideration is wholly contingent upon the exercise of the choice or right of election it is merely a continuing offer of sale and may be withdrawn by the grantor at any time before acceptance by the grantee or its equivalent. Under the terms of the option, taking possession and making improvements on the property may be equivalent to an acceptance. It is usually provided in an option that if, after partial payment made, default occurs, the amount already paid shall become the property of the grantor as liquidated damages. The option may provide for immediate possession and working of the property with or without the right to reduce or appropriate the mineral taken therefrom and account to the grantor therefor. It is then sometimes termed a working bond.

In case the option involves a transfer of real estate, it is usual to execute contemporaneously a deed of conveyance for the same, or, if it involves the delivery of stock, to place such deed or stock properly indorsed in escrow, that is, to put the deed or stock in the hands of a third person, usually a banking house, to hold until compliance with the conditions of the option by the obligee, then delivery is to be made to him, or upon his default, returned to the obligor.

The option, when it affects the transfer of real estate, is usually placed on record. If there is no escrow and the obligee complies with the terms of the option, the option may be construed as a bond for a deed, or a contract for delivery of the shares. A bond for a deed is a bond binding the seller to convey the property to the buyer in consideration of receiving the agreed price. Although it is a well established rule of law that title to real property does not pass until due delivery of the deed, yet the courts are not in accord whether wrongful delivery by the escrow holder to the obligee passes the title or not, even when thereafter passing

to an innocent purchaser from the latter.

An innocent purchaser is one who buys a thing in good faith for a valuable consideration without notice or knowledge of any default or flaw in the title of the seller, or that the value of the property has been inflated, as an inducement to purchase or entering into arrangements to do so. A person claiming to be an innocent purchaser must establish that fact in order to maintain the contention. When a person buys property on the faith of acts or representations fraudulently made and upon which he relies, he may rescind the contract or deed.

It is usually provided in an option that time is of the essence of the contract; but that need not necessarily be expressed, for, as previously stated, time is necessarily of the essence when a thing like mining property may be of greater or less value according to the effluxion of time. Where it is provided that in default of payment the property shall revert to the obligor, it is not necessary for him to rescind nor offer to return the payments previously made. Fraudulent acts and false representations by the obligor or his agent, which induce the contract, will entitle the obligee to rescind and recover back payments made; for instance, as the salting of the property. Salting consists in the surreptitious placing of valuable mineral in such form and place within the property as the characteristics of the claim may require, or in tampering with the samples taken therefrom or from or in the mill or other reduction works, with the intent to give increased apparent but misleading value to the property and so induce its sale at a price greater than its merits warrant.

It is not a fraud in a purchaser to conceal from the seller the mineral value of the land, or the output of adjoining property, provided there be no wilful misstatement of a material fact, nor any act intended to mislead the seller as to the value of the land. A mere misrepresentation of value not fraudulently made and stated to be on information gained from others, will not avoid a contract of sale. The party who has been defrauded may **keep the property and sue for damages**, or repudiate the contract, restore the property and demand the return of his money within a reasonable time after discovery of the fraud.

DEEDS

A mining claim is real estate, and it can be transferred only by operation of law, or an instrument in writing, that is, a deed of conveyance; but one who has discovered mineral may transfer his right of location by parol; or by deed before discovery and after location. The true name of the grantor or the grantee is not material to the validity of the grant, but a valid deed cannot be issued to a fictitious person, nor to a corporation there-

after to be formed. If several persons are named in the deed as grantors, but the deed is not executed by all of them, it is operative as to those who do. A conveyance of additional ground to or a transfer of its ground from a corporation will not pass title, nor will a mortgage or a lease be valid in the absence of the expressed assent of a majority of the holders of its stock, when such assent is required by the local statute.

While nothing passes under a deed without consideration, it is not necessary (unless required by local statute) that the true value or any consideration be named therein. The true consideration may be otherwise shown. The actual consideration may be a pecuniary one, as money, or shares of stock, or it may be for "love and affection."

If a mining claim has a known descriptive name, it may be described by that name in the deed and by proper reference to the record of the location or patent for a more particular description. It is sufficient if the property can be identified, and this may be aided by parol testimony, or by part of the description; as when the wrong legal subdivision of a public survey is given and the remaining description sufficiently identifies the land. The general rule is that when the boundaries of real estate are inconsistent with the measurements, the visible monuments prevail. But in the case of a mining claim, if the monuments show an excess of ground, the claim will be limited to the statutory extent within such boundaries. For example, in a case where a claim is described as running 1500 ft. southerly from the northern stake would end a short distance north of what is claimed as the southerly end line, or, on the other hand, where the distance named is for less than the designated distance as to another mining claim the true boundary will extend to such mining claim.

The words mining ground when used in a deed, have a technical meaning. They refer to that interest which a mere occupant of a mine has in the same. They are not the words used when a fee-simple title or leasehold interest in real estate is to be conveyed.

No precise form of deed is necessary. It is sufficient if it be clear from the language used that the grantor intended to pass the title to the property and whatever is incident or appurtenant thereto. The courts do not agree as to whether a ditch, used in connection with a mining claim, passes as an appurtenance, or should be specifically named in the deed. The deed is usually in the form of a "grant, bargain and sale deed," or "quit-claim deed." The difference between them is that while each passes whatsoever title the grantor had at the time of the sale, the former carries all the title he may afterward acquire to the property, while the latter does not. In neither case can the grantor attack the validity of the

location. The courts are not in accord as to whether the failure of the grantee to make the annual expenditure on an unpatented mining claim will permit the grantor to make relocation thereof because of such delinquency.

A conveyance in the ordinary form passes all mineral, but this may be reserved. So the deed may limit the grant to the surface or mineral thereunder, in which case each becomes an independent estate. Whether the instrument conveying the right to the mineral is an irrevocable grant, or a revocable license, is determined by the language used therein. A grant of the right to enter on land for mining purposes only and to prospect and mine the same, if not exclusive in terms, will permit the grantor and his subsequent grantees to prospect and mine in the same land.

If there is no delivery of the deed, it is not valid. Valid delivery is accomplished when the acts and conduct of the grantor manifest present intent to dispose of the title conveyed and acceptance by the grantor, which latter is not necessarily explicit. The recording of the deed is evidence of its delivery, and it is presumed to have been delivered at the date of its execution.

A deed is not entitled to record until acknowledged. The acknowledgment should be that of the grantor, or of a subscribing witness. When recorded the deed serves to give constructive notice of the transfer to all the world.

A deed is valid as between the parties thereto, though not acknowledged nor recorded, and is effective against one who has actual notice of its existence.

A deed may be annulled at the instance of the grantor because of the fraud or deceit of the grantee, as by his falsely denying the existence of mineral in the land, for the purpose of inducing its sale at an inadequate price. But inadequacy of consideration alone is not sufficient ground to set aside a deed. The grantee may cause a deed to be annulled because of the fraud or deceit of the grantor, as salting the property conveyed, or fraudulent representation as to the value of the "ore in sight" (the words "ore in sight" have been held by one of the courts to mean ore-bearing rock so separated and blocked off by being worked around on two or more sides that it is subject to examination and measurement); or the deed may be annulled for failure of consideration, as that the land described in the deed had previously passed to another and the grantee took nothing thereby. No deed will be set aside for fraud unless the fraud is clearly shown.

THE PATENT

The patent is the deed of the Government issued by the land department upon application made in conformity with the terms of the mining act and the rules and regulations thereunder promulgated

and enforced by the department. It is issued for a lode or for continuous lode claims and mill sites, if owned in common, combined or separately, and for a placer or contiguous placer claims, a "known lode" and mill site, if owned in common, combined or separately. Independent patent may be issued for land within the same general area, as for a "known lode" within a patented placer claim, or as for land known to be valuable mineral land within a patented townsite, or a valid mining claim within land subsequently patented under the stone and timber act. No patent is issued for a tunnel claim as such. No prior subsisting lien is impaired by the issuance of a patent for any class of mining claims.

A lode patent conveys the right to the surface, the rights incident to common-law ownership of land and the extralateral right, whether the latter be expressly named therein or not. A placer patent does not determine that a "known lode" subject to separate patent does not exist within the area described therein. Nor does a lode patent determine the non-existence of rights in a prior tunnel claim.

A patent relates back to the time of the location and cuts off all intervening adverse rights. It concludes, except as between the Government and those claiming under the patent, all question as to the character of the land, the validity of the location and that all the terms of the law have been complied with. The receipt issued by the receiver of the local land office in patent proceedings is substantially equivalent to the patent, at least as far as the rights of the third parties are concerned. But this receipt or certificate may be cancelled or suspended by the land department for fraud in obtaining it, or because the applicant failed to comply with the law or that the land is not of the character assigned to it. The land department loses jurisdiction over the laws when patent actually issues. While a patent is deemed the highest evidence of title and while the presumptions of law are all in its favor and can only be overcome by clear and convincing proof, still it may be attacked because issued without authority of law, as for land which has been reserved or otherwise granted, or because issued during the pendency of an "adverse claim suit," or because of the inadvertence or mistake of the land department in issuing it, or because of the fraud of the applicant in obtaining it.

If the patent is void, as when issued without authority of law, it is subject to direct and collateral attack. If voidable, as because of the wrongful classification of the land described in the patent, it is subject to direct attack only. A suit brought by the United States to annul a patent must be commenced within five years after the date of the patent. A party attacking the patent must show that he is in privity with the Government, that

is, one who stands in its shoes must be able to show in his pleading and proof that he had the right to demand title from the United States, as by a valid location existing at the time the patent was issued. In other words, he must distinctly allege and clearly prove that he occupies such a position as gives him the right to control the legal title.

The patentee may be the trustee of one or more persons not named in the patent, as when one of several co-owners obtains the patent in his own name, or procures a patent for a timber or stone claim in fraud of the rights of the owner of a valid subsisting location. In such a case suit may be brought by the injured party to enforce the trust against the fraudulent patentee and compel him to make a conveyance of the title *pro tanto*. Such a suit is not an attack upon the patent but an assertion of a right thereunder. The maintenance of such a suit may be largely controlled by the question of laches of which lapse of time, acquiescence, change in the value, or character of the property, are the principal features. Yet mere lapse of time less than the period of limitations, may not bar the action, as each case depends upon its own particular facts.

Many mining claims, or more strictly speaking, many mines are held under agricultural patents issued by the Federal or State government, and it has been held that where a patent issues for public land under a law which provides for its disposition as agricultural land either to a railroad company or to pre-emption or homestead claimants and there is no reservation in the law except a general one of mineral lands, and no reservation at all in the patent, then the patent must be considered as a conclusive determination by the Government that the land is agricultural. Upon principle the rule applies with equal force to a patent of a State government. It has been expressly held that the State patent is the record of the State that the land was subject to location under the grant of the United States to the State and had been located.

Tungsten Mining in California

SPECIAL CORRESPONDENCE

In California, tungsten ores are mined chiefly in San Bernardino county. It has recently been reported that extensive tungsten deposits have been uncovered in the Signal mining district, eight miles east of Von Trigger. In the northern part of the county wolframite and hubnerite are found; these resemble closely the ores of Osceola, Nev., and the Dragon mountains, Ariz., which carry 74.10 tungsten trioxide; 18.9, iron protoxide; 4, manganese protoxide; and 3 per cent. silica. Twelve miles north of Goff on the Mojave

desert another deposit has been located.

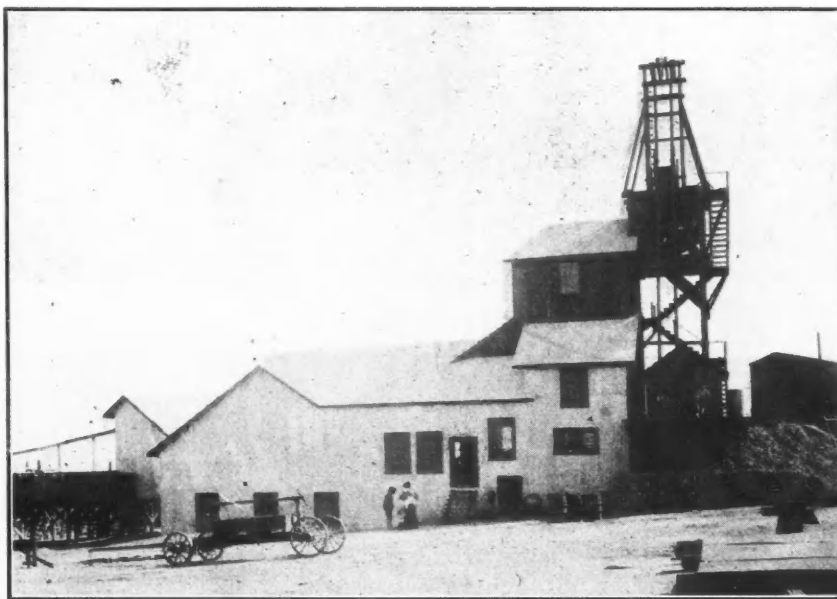
The most important discovery in the State was made near Johannesburg in 1904. In this region the largest mine is the Papoose, of the Atolia Mining Company, of which DeGolia & Atkins, of San Francisco, are managers. It has produced over 500 tons of 70 per cent. ore and concentrates. A busy camp, Atolia, was maintained at the property, and a full crew was kept at work up to the time of the recent financial depression, when the mill was closed down.

The geology of the region near the Papoose mine is comparatively simple. The ledges which carry the mineral strike almost due east and west. They are somewhat distorted and broken, and have an average dip of about 20 deg. to the north. The country rock is grano-diorite, covered with a reddish granular soil, or wash, ranging from 6 inches to several feet in depth.

the ore and waste are received in separate chutes. When ore is plenty the empty waste bins are utilized in caring for the surplus ore. In the event of an excess of waste all available chutes are made use of to clear the stopes.

The unusual dryness of the region is a great advantage in saving the expense of extensive timbering. Excepting the linings for the shafts, and that used to build the underground bins, little timbering is required. In the stopes few heavy timbers are required. It may be of interest to note that a shaft driven 1100 ft. in a neighboring gold mine does not show the least indication of the approach of water-bearing strata.

The ore, which is emptied into bins at surface, is fed into a Blake crusher, from which it falls to the supply bin. Next, by means of an automatic feeder, it is introduced into a Huntington mill, where it is



CONCENTRATOR AT ATOLIA, CALIFORNIA

To the west the ledge matter is iron-stained. To the northwest a black schist found in the gold mines of the Stringer district carries small quantities of tungsten ore. Farther to the north is the property of the Yellow Aster Gold Mining and Milling Company; it is said that tungsten ore occurs here. Two miles directly north is a peculiar rock occurrence, called Red mountain, composed of a hard, blue porphyry and coated on the exposed surfaces with an oxide of iron.

MINING AND MILLING

The main shaft of the Papoose has been sunk 250 ft. following the dip of the ledge; drifts have been driven at 50-ft. intervals. For safety and ventilation secondary shafts connect the drifts with the surface. Breast stoping is adapted to the mode of occurrence of the ore. From the stopes

crushed to 20-mesh. This material is fed to five vanners. The concentrates are loaded upon trucks and run to the drying house, where they are spread on the hot, steel floor, heated from underneath by wood fires. The moisture having been sufficiently reduced, the product is packed in heavy twilled sacks lined with duck, each sack, when full, weighing 116½ lb. The high-grade ore is sacked in 110-lb. sacks after having been sorted out of the lower grade material and cobbled. It has been found here that a higher grade concentrate can be obtained by fine grinding; the limit of efficiency is accordingly governed by the time required in attaining the purer product. Connected with the mill is a sampling plant, with wagon scales, 7x8 Dodge crusher, Chymunk grinder, and disk-pulverizer. This was added to the original plant in order to handle the custom ore offered from time to time.

Operation of Carmaux Coal Mines in France

A System of Mining Thick Seams in Slices and the Use of Hydraulic and Hand Filling to Prevent Surface Subsidence in Longwall Work

BY LUCIUS W. MAYER*

The town of Carmaux is situated in the department of Le Tarn, southern France. There are about 10,000 inhabitants, who speak a patois not generally understood by the northern Frenchman. There are also a large number of Spaniards throughout this district.

Coal was first mined at Carmaux in

called Compagnie des Mines de Carmaux. In 1906, 1,110,907 tons of coal were produced by the three mines comprising the group. The product involved a gross value for the year of \$2,413,146, or \$2.17 per ton. The cost of producing was \$1,882,576, or \$1.69 per ton, and the profit \$530,570, or 48c. per ton.

the seams approach the surface. Schists and sandstones figure largely throughout the entire field, and their bedding with the coal makes elaborate washing operations necessary. The formation is of Permian and Upper Eocene age.

In certain parts, the schistose cover over the seam is of an inconsistent nature, and

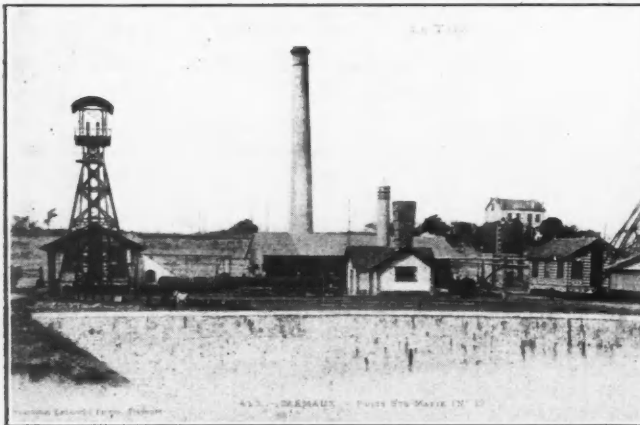


FIG. 1. A PORTION OF SAINTE MARIE NO. 1 PIT



FIG. 2. LA GRILLATIE WAS ONE OF THE FIRST PLANTS BUILT



FIG. 3. THE TIMBERING IS NOT ALWAYS PLACED WITH THE GREATEST REGULARITY

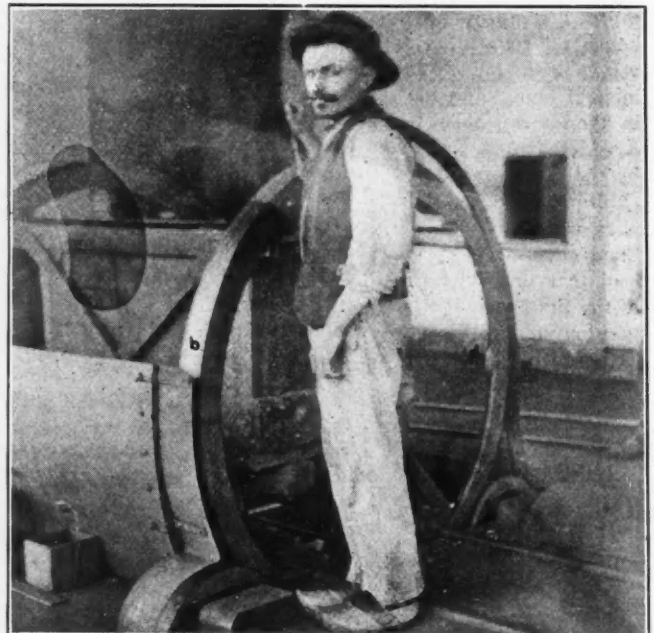


FIG. 4. THE UNLOADING DEVICE IS A MECHANICALLY-OPERATED CYLINDRICAL DUMPER

1247. In 1747 privileges were granted to the Marquise de Solages, whose descendants are still in possession of the mines. It was not until 1865, however, that the present company was formed, which is

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GEOLOGY OF THE FIELD

Fig. 5 is a geological section of a portion of the concession. There are six distinct coal seams. To the north and east, the coal rests on mica schists and gneisses which limit the coal area. At this point,

when exposed to the direct action of the air, on removal of the coal from under, has a propensity to swell, causing roof falls and consequent danger. In France, it appears that the precautions taken for the protection of life are greater than anywhere else, and the result is seen in the

record made by the French mines in having a low percentage of fatalities.

Above the coal-bearing formation is a cover of plastic clay and sand, of Tertiary age. This material, which averages about 50 m. in thickness, is excavated with bucket dredges and conducted to the mine openings to completely fill the space left by the coal. The seams are variable in thickness, and while the coal band itself generally attains no greater thickness than 3.80 m., it is generally found necessary to mine the intervening bands of schist and sandstone simultaneously with the coal.

the cage at its ends rather than at the sides. A better arrangement of space is aimed at, no room being occupied between the cages for guides. At the shaft mouth, there are no guides for a length of about 2½ ft., in order to allow the cars to pass off the cage. However, the shoes on the cage are always engaged about the guides, at some point, either above or below this 2½-ft. space. Where there is an intervening level in the shaft, and this arrangement of having the guides in the end of the cage is used, in order to have a continuous track down the shaft, a section of

whereby the dogs are held away from the guides while the cage is on the chairs. A rod is fixed between the two dogs, drawing the dogs in, and thus preventing their engagement with the guides. On descending, the rod is disengaged, and the dogs are again placed in position.

VENTILATION AND LIGHTING

At La Tronquié a multi-cellular centrifugal pump is working under a single lift of 400 m. At both La Grillatié and La Tronquié, Guibal fans of 9 m. diameter are used. At Sainte Marie, a Geueste-Herschler 2-m. fan is used, which is of the exhaust type, making 170 r.p.m., using 90 h.p., and exhausting 37 cu.m. per second, with a depression not exceeding 34 mm. Alternating triphase motors operate these fans.

For lighting purposes in the mine, an odd-shaped oil lamp is used, which burns what is known as Colza oil. This lamp is shaped like a canteen, suspended from a U-shaped bracket, to which is linked a small pick. This pick, having a sharp point, is readily engaged in a timber, and the lamp thus suspended.

A mine car prevalently seen in the camp is one formed with angle-iron skeleton frame, the body being closed by boards which are set in this frame.

On the incline, the method of fastening

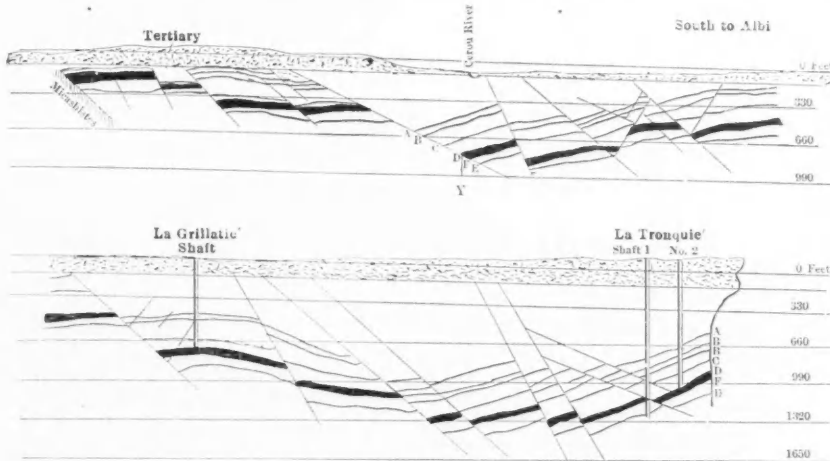


FIG. 5. GEOLOGICAL SECTION OF PART OF THE CARMAUX CONCESSION

On the Carmaux company's concession there are three main shaft sites, each one having several pits. There are 3250 workmen employed at the mines; 2000 of this number being employed underground.

A peculiar condition exists in this camp, in that the miners are subject to a severe illness, known as "ankylostomiasis," produced by a worm, which, finding its way into the system, permeates the intestines. For a long time it was unknown what produced the illness, until a royal commission finally learned its cause, and now the men take an antidote regularly to counteract the action of the worm.

Fig. 1 shows a portion of Sainte Marie No. 1 pit; Fig. 2, La Grillatié, was one of the first plants built. The odd construction of the shaft house is noted in Fig. 2; the headframe itself is formed of tubular iron.

DIMENSIONS OF THE SHAFTS

The two shafts at La Grillatié are 3.50 m., and 2.70 m., respectively, in diameter. There are two levels; one at 168 m., and one at 209 m. One of these shafts is elliptical in form. Two shafts at La Tronquié are 3.50 m. in diameter, while the principal pit of Sainte Marie is 4.10 m., and the second main pit 3.60 m. in diameter.

THE GUIDES AND OTHER SHAFT EQUIPMENT

At Ste. Marie, the filling leaves the cage at 156 m., and the coal is hoisted from the 206-m. level. A number of unique arrangements are installed about these shafts. Timber guides are placed to hold

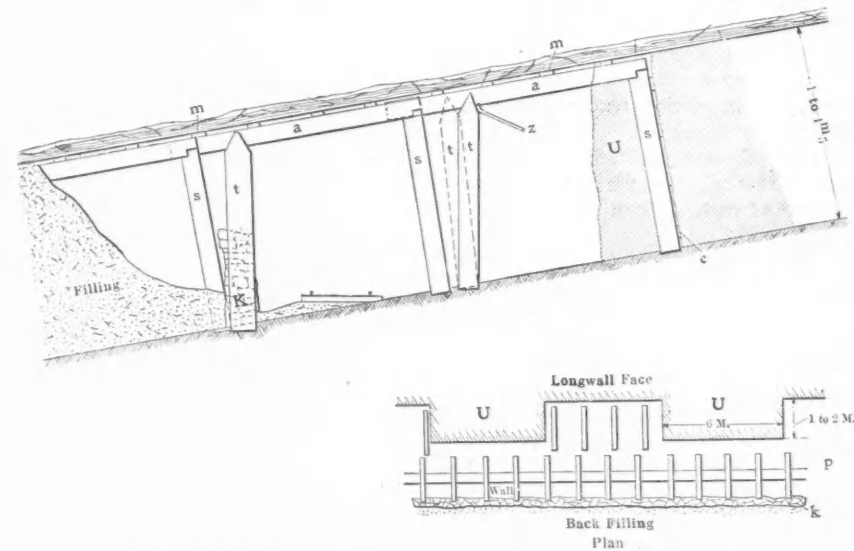


FIG. 6. THE POSTS ARE SET PERPENDICULAR TO THE LINE OF DIP

guide is hung on a gate, which must be closed firmly when hoisting is going on in the shaft past this level.

Hoisting ropes are flat, and of hemp. They are generally bulky, often weighing as much as 11 kg. per meter of length. The ropes average about 290 mm. wide, and 45 mm. thick. The reason for using hemp rope is not clear to me. I am told that during the first year's life of one of these ropes, as much as a meter has to be cut off each month, due to stretching.

Strong safety dogs are used on the cages, but no rope-disengaging device. There is an arrangement on the cages

chains to the cars is by means of two hooks, one fastened to the bottom of the car, and another short length of chain, with its hook, leading to the top of the car. It has been found that by this arrangement, the best balance and control is obtained.

THE CYLINDRICAL DUMPER

The unloading device on the surface is a mechanically-operated cylindrical dumper. This is shown in Fig. 4. To the right, as shown at a in the illustration, a lever encircles the rim of the cylinder. At a short distance above the floor,

there is a small solid wheel set in the lever bar. There is also a recess notched in the cylinder rim. In Fig. 4 the cylinder has revolved, and the recess has presented itself to the solid wheel. The moment that this small wheel *b* enters the recess, the cylinder ceases to turn, for the lever *a*, which controls the mechanism below, causes a disengagement of the motive medium.

When the lever, *a*, Fig. 4, is raised, the wheel, *b*, is withdrawn from the recess, and contact is formed between the cylinder and the revolving mechanism below; the cylinder again is caused to turn, the small solid wheel now riding on the rim of the cylindrical frame, *d*, Fig. 4.

Power is furnished by an electric motor, contact between the revolving mechanism and the cylinder continuing just as long as the wheel rides on the rim, during which time the lever is raised. When the recess again approaches the wheel, the latter enters the same, a complete revolution having been made.

The system of shaft signaling at these mines is an electrical arrangement similar to that used on shipboard, whereby a reply is received by means of pointers on a circular dial about 10 in. in diameter. The station tender revolving the signal lever to the order which he wishes to convey, is answered by the hoistman, who goes through a similar operation, causing a second pointer to revolve on the dial from which the original signal was given, thus informing the station tender that all is ready. The station tender now gives the final hoist signal. The Siemens-Schuckert Company, Berlin (formerly Siemens-Halske), are the largest manufacturers of such devices.

SAFETY ARRANGEMENTS

A recent invention which has been installed at various large collieries, on recommendation of the government, particularly in Germany, is the Siemens-Ilgner system of safety gears for hoisting engines. By this arrangement, the movement of the throttle is controlled by the position of the indicator, and the driver is compelled to adhere to the rate of movement of the cage, which has been prescribed for it. The behavior of the cage as it approaches the landing, and all during its flight, is in this way controlled by means of a cam of certain profile, such that the distance through which the driver can move his lever is limited. At the same time the driver is always able to draw back his lever to reduce speed.

A central power plant produces electricity for all the pits of the Carmaux company. Four engines produce 420 h.p. each. The motors are of the Siemens-Halske type; these are tri-phase 50 cycles. The voltage is transformed to 5000 from 240. This plant was completed in 1901.

A modern coke-producing plant is operated in conjunction with the mine. The

central washery, built of steel, is located at the same point. The Humboldt system is in operation. Passing through this building, the method of evenly distributing the coal in the bins from above is interesting. There is a spiral-shaped launder, made of metal and about 18 in. wide, standing from the top of the bin to the bottom. The coal slides down this launder, and after coming in contact with the coal below, goes off at a tangent from the spiral conductor and is distributed in the bin.

The coke plant consists of 134 furnaces

METHOD OF MINING

The method of mining at Carmaux is extraordinary, and meets the requirements of the district admirably. Maintenance of the surface is well accomplished, as well as a high extraction of coal from the area, and safe working. A modified system of longwall is used in all the seams, and the area mined is filled with sand brought from the surface. The mining system might be termed "retreating longwall in panels with complete stowage."

It has been observed in Fig. 5 that the

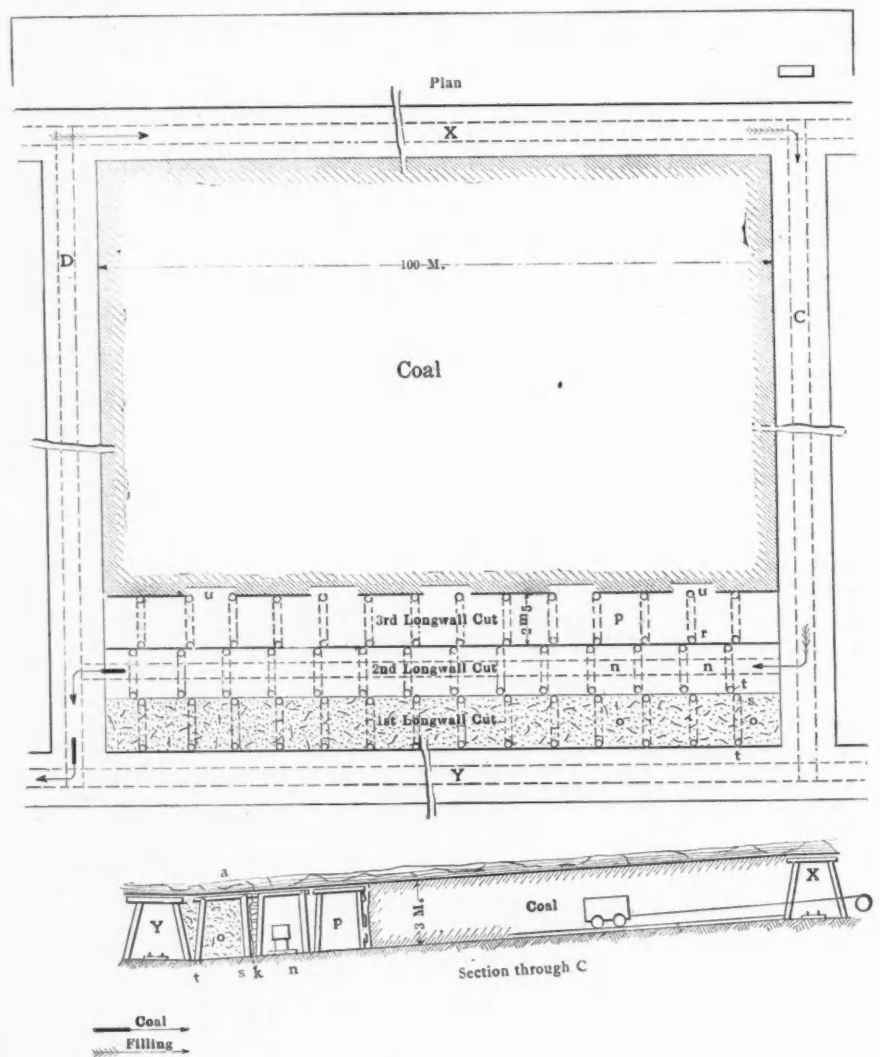


FIG. 7. A GENERAL SYSTEM OF MINING A 2½ TO 4 M. SEAM

of the Coppee type; each gives over four tons of coke, after 48 hours treatment. The furnaces are in groups of eight, and produce two classes of material. One, from 0 to 12 mm. in size, is made into briquets, and 0 to 6 mm. material is used for ordinary coke. After proper coking, the entire block of burned material is shoved off the horizontal shelf in the furnace on which the coke rests. This is accomplished by a long arm with plate attachment at its end, which butts up against the block of coke and shoves it out of the furnace in its entirety.

ground is much faulted, which fact figures in the method of mining adopted. The first step in attacking a seam is to follow in the direction of the dip, turning off roads at intervals of approximately 100 m. These roads are continued until the plane of the fault is encountered, when the blocks of coal are laid out and the ground worked on a retreat upgrade. The filling is brought in to replace the coal mined out.

It is endeavored to arrange communication with a shaft so as to allow sufficient fall for the cars of coal to go out by

gravity, and the filling to come in from the quarry in a similar manner, from another elevation. Cars of coal coming from the mine are unloaded, and proceed immediately to the point where bucket dredges are mining the filling material; they then return to the mine down the inclines and are emptied at the face. This process is not necessarily continuous. The filling may be brought into the mine at such hours as to suit the work of coal cutting. With a few exceptions, cars from the entire process are moved by gravity force. At La Grillatié, more than a mile is traversed by a car from the time it leaves the face with coal and returns with filling. Here the coal is raised through a

The longwall system is operated on all the seams, in either one, two, or three slices, according to the thickness of the bed. The method of filling is either to bring the sand from the quarry dry, dumping and filling the roads at the face by hand, or else, by a system recently introduced, of flushing the sand in with water, building barriers behind the face to hold the sand intact, and allowing the water to drain off. The introduction of the filling is quite the same as previously described. I took occasion to examine a seam 4.5m. in thickness, and worked in one horizontal slice, with hydraulic filling behind the face. This is the thickest bed of which I have record, where any at-

places where the inclination approached close to horizontal.

The system of mining is generally free of dangerous features, although frequent slips of horses in the roof, due to vertical partings, are the cause of occasional accidents.

Fig. 7 shows a system of mining a 2½- to 4-m. seam. Let us assume in Fig. 7, that gallery Y is at the lower elevation of the coal seam, a fault having cut the formation at this point. Gallery X is at an elevation about 50 ft. above Y. Incline C has been run to connect X and Y. Starting at the bottom of the coal, the first cut *o* is made 9 ft. wide, extending approximately 100m. in length. The gang-

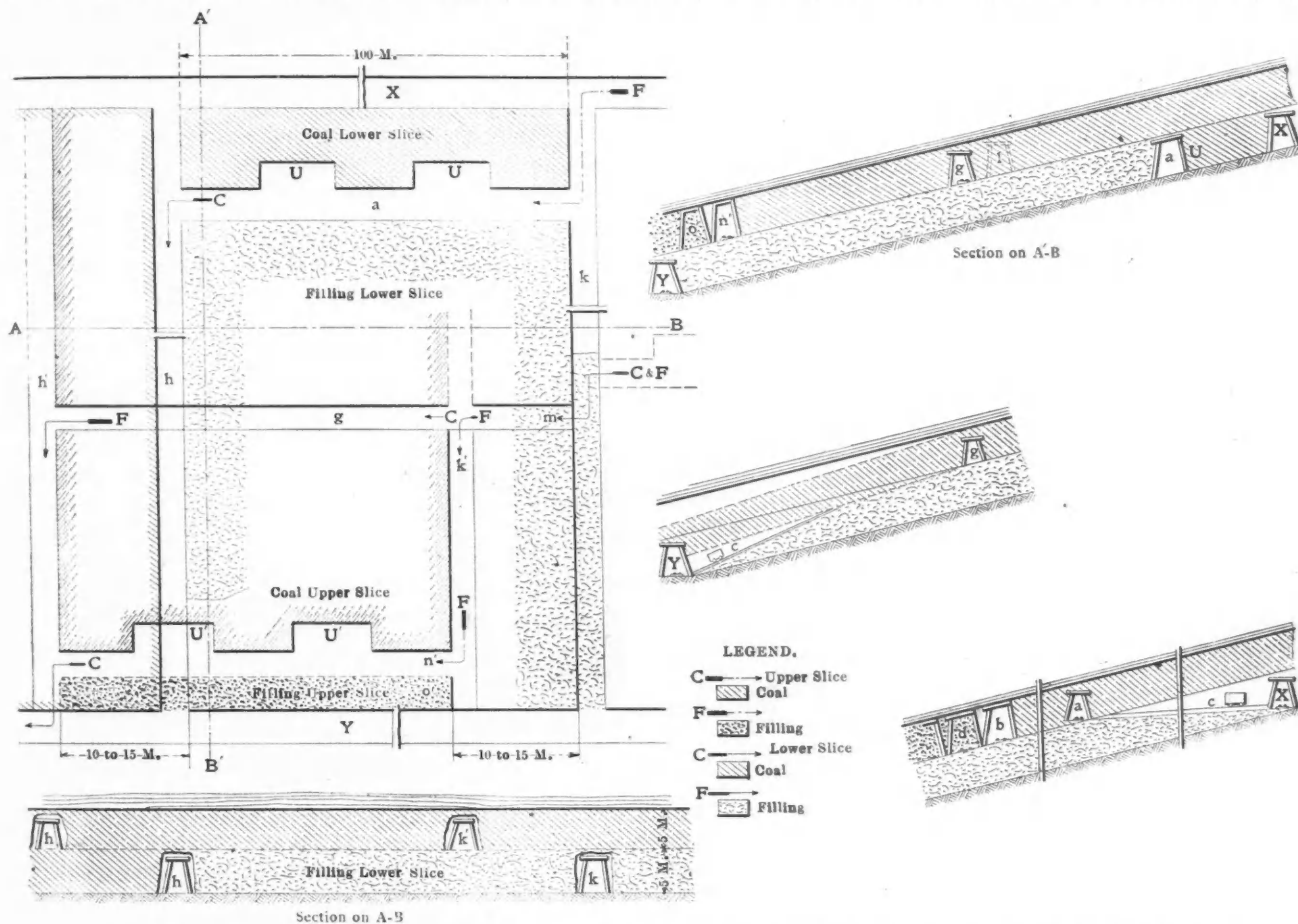


FIG. 8. GENERAL SCHEME OF MINING BY TWO SLICES, SHOWING METHOD OF HANDLING THE COAL AND THE FILLING

shaft and the cars re-enter the mine with the filling through a tunnel.

In Fig. 1, cars are shown returning to the quarry, stopping on the way to be unloaded of the coal. The method of breaking down the filling material, is to use an electrically operated dredge. According to the topography, the dredge either works as shown in the accompanying illustration, or, in another location, may work against a bank. The dredge buckets are operated by a 30-h.p. motor, the lateral movement of the dredge itself being controlled by a 10-h.p. machine. One hundred and twenty cars of ½ cu.m. capacity are filled per hour. The arm carrying the buckets is manipulated by a 7-h.p. motor.

tempt at the longwall system is made. It is, of course, questionable whether longwall could be operated with such a thickness without complete filling.

The mining of a 6-m. seam was also investigated, where the coal was being taken in two slices, and dry filling replacement introduced. It may be argued also that longwall would not be practical in these seams were it not for the dip of the floor, which makes this method of filling practicable.

The natural grade allows cheap haulage; the water readily drains away, and close packing of the sand is naturally accomplished. A dip of 30 deg. was met at points, but it was not uncommon to see

way *D* is started up the rise to block out the area. The cut *c* is not advanced in one straight sweep, but the face is attacked by means of a cut shown at *u*, Fig. 7, and at *u, u*, Fig. 6, these being constantly advanced left and right.

METHOD OF TIMBERING

In the ordinary longwall, the regular sets of timber are not generally employed; caps are not often used, but simply posts with a top plate, and not always placed with the greatest regularity. Here, however, the form of set shown in Fig. 3, is used, and there is little necessity for the introduction of auxiliary props. When the face has advanced approximately 9 ft.,

posts *s*, Fig. 6, are set perpendicular to the line of dip. Cap *a* (all figures similarly lettered) is held up temporarily for the post *t*. Prop *t* is cut longer than the vertical distance which it is supposed to occupy. It is cut by machine to the shape shown in Fig. 3 and is set by means of a lever, as shown at *z*, Fig. 6. Post *t* is not set parallel to post *s*, but with the purpose of counteracting the downward thrust of the roof. As the force acts, the post tends to the vertical, as shown in the dotted lines, and being of excessive length, a tight set-up is effected.

The track on which the cars run is continuous, back of the face. The latter is constantly advancing, until there is sufficient space ahead for another complete set of timbers, but in the interim, the posts may be set up irregularly for safety, until the distance has been made, and a complete set of timber set up in the regular form. If the face has advanced at

used at the face is reused, but no other timbers are withdrawn.

Let us consider in Fig. 7, that the first longwall cut *o* has been completed. Cribs are set at intervals, and stone walls are built, as shown at *k*, in Fig. 6, behind the last row of timbers. This would be the fourth set of timbers behind the face in each case. This operation of building the wall is a regular feature, and part of the system. The purpose of same is to hold the filling intact and away from the track, which track is placed behind the third row of posts.

In Fig. 7 note that the filling will always come down gangway *C*, and after being dumped behind the face, the coal will go out to the shaft in these same cars, going down gangway *D*, along the gallery *Y*, and eventually to the level of the main roadway, communicating with the shaft. When the grades are too steep for hand control of the cars, friction de-

block; one slice will be in the course of being filled, while in the second there will be a track, and in the third the work will be advancing.

Where a seam is too thick to be mined in one division, coal is taken in a number of horizontal slices. A $4\frac{1}{2}$ - to 6-m. seam would be mined in 2 lifts, of $2\frac{1}{4}$ to 3m. each, and a 6- to 10-m. seam, in 3 lifts. The interval of working the lifts is usually a year; that is, the mining of an upper slice follows about a year after the coal in the slice below has been worked out. Slices in any one block may be mined simultaneously.

MINING A 20-FT. SEAM

Following is a method of mining a 6-m. seam in two slices of 3m. each. It is remembered that the lower slice is not necessarily all mined out in any one block, but the upper coal is resting on the filling, which has replaced the coal removed in the lower slice. Note that in mining by this system, a number of slices are taken, and the cars must eventually gain a certain elevation before getting to the shaft. The gangways leading up to the shaft always remain at the same elevation, but the coal seam itself is attacked at the various elevations of the slices. It is at this point that the complications set in, especially where a number of slices are being operated in the same block. The method of connecting one slice with another, and eventually making the elevation which leads to the shaft, is by means of inclines. The arrangements involve more or less elaborate timbering, and an intelligent arrangement of the work, which will look to economic arrangement and non-delay of operations.

There is a certain amount of settlement which takes place when a slice has been filled, so that all the slices are not removed from their original position. This settlement aids in making connections between the slices. It also plays a very important part in the breaking up of the coal, and renders extraction easier, due to the natural parting of cleavages in the coal.

After about a year with dry filling, a complete settlement is obtained, after which an upper slice is started directly above. It may be that a lower slice is completely removed and filled before an upper one will be begun. Referring to Fig. 8, and noting the characteristics which mark the coal and the filling in each slice, it will be noticed that slice No. 1 has been mined to within a short distance of the upper gallery *X*. The letters *F* and *C*, behind the arrows, refer to filling and coal, respectively.

WORKING THE UPPER SLICE

Starting the upper slice, roads *k'* and *h'* are run 10 m. to 15 m. from the plane of the corresponding parallel roads, *k* and *h* in the lower slice. Road *k'* is run first, and when reaching

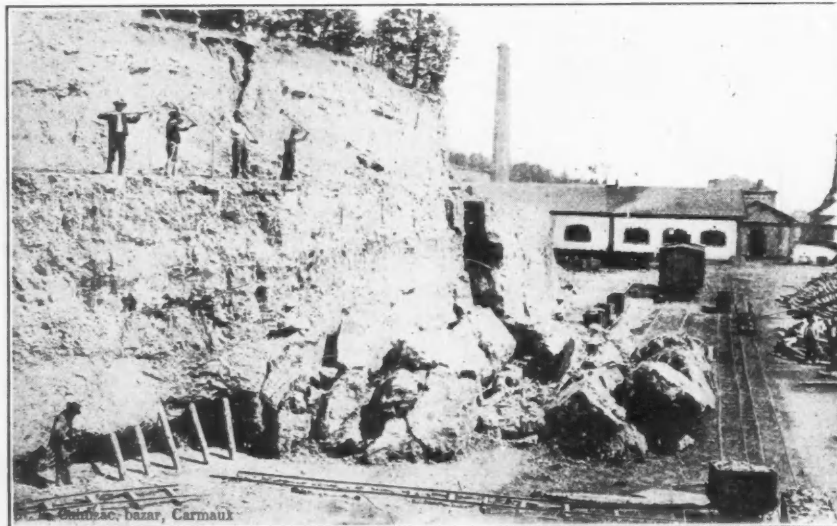


FIG. 9. OLD METHOD OF BREAKING DOWN FILLING MATERIAL

one point in a cut-in *u*, timbers are set up to the face at this point.

Note that the caps *a* not alone overlap the post *t*, but often overlap *s* of the post behind, as shown in Fig. 3. Post *s* is set up against the coal face as soon as the distance is made.

The distance between sets along the face varies, according to roof conditions. At certain points, the roof is particularly treacherous, and the coal brittle. In conjunction with this feature is the height of roof, which makes it more difficult to test, so that extreme caution has to be exercised. At some places, the posts are not more than 4 ft. apart, and the lagging under the roof hardly more than 2 ft. At such points, the posts *s* were setting closely against the face, lagging was carefully placed between these posts, and the only part of the face which was unprotected, is where the miner was drawing down coal with his pick. The lagging

is introduced at the head of the inclines. At one point I noticed a brake-car which was set in front of the loads to resist their movement. The mechanism was operated by a man who sat on the truck. The brake-car consisted simply of an ordinary truck, equipped with a strong brake device. This truck, on delivering its loads, was drawn to the top of the grade by horse haulage. In order to arrest the movement of the cars at certain points, specially made dagger-shaped metal sprags with cross-piece were used.

Referring again to Fig. 7, the condition existing is: Longwall cuts No. 1, *o*, and No. 2, *u*, have been completed; No. 3, *p*, is being worked. A sufficient distance has been made in *p* to allow the introduction of sets of timber. The filling is coming in regularly, and the slice *o* is practically filled. The wall *k* runs the complete length of the block. Conditions, as shown, will repeat themselves all the way up one

a point about midway up the block, a cross-road *g* is cut across the block. The method of working the upper coal is quite the same as work in the lower coal; in fact, the working of coal in multiple slices is exactly the same for each slice as if there were to be but one single horizontal cut; the feature lies entirely in making connections, for haulage between the elevations of the various slices, and the main road to the shaft.

It has been noted that the entire output from all the slices, whether two or three, must eventually be hauled out of a main gallery, as *Y*. Similarly, the filling has to find its way from the main gallery *X* (which in turn connects with the upper level) to the elevation of the upper slices. Various adjacent blocks of coal may be under fire at the same time, and wherever possible, communication is effected between slices of one block and the slices of another block. This effects economy in the transfer of the filling and the coal.

In Fig. 8 gangway *k* has been filled up to a certain point, and it can be seen that the filling is coming from an upper slice of an adjacent block *l* going down gangway *g* from *m* and continuing to the incline *k'*, and then to the longwall cut *n'* to fill *o'*. Coal is loaded in this road *n'*, in the cars which just brought in the filling, and depart for the gallery *Y* by means of an incline connecting *k'* and *Y*. This arrangement is shown, in exaggerated form by the small section to the right and center of the illustration; the coal here has settled from 30 to 50 per cent., and the filling has all been placed dry.

There is really no occasion for *g* to be run across the entire block, because the filling for *n'* goes down the incline *k'*. Similarly *h'* need not be run up any further than is necessary to effect communication between *n'* and gallery *Y*. However, it is assumed that an adjacent block is being worked, or is to be worked shortly.

WORKING THREE SLICES

In working three slices the system is quite the same, except that slice No. 1 will have been completed before slice No. 2 of any block has been started.

The method of mining here described has been in practice for a long while. With the dry filling, a considerable amount of subsidence on the surface has been felt, in spite of the depth to which mining has been carried on. Recently a system of bringing in the sand with water has been adopted, after exhaustive experiments, both in foreign fields and at the local plant. An experimental plant was first built, and the amount of water required to properly flush the material, also the mechanical arrangements were tested. The system of water flushing is not in general use yet at all the mines, but wherever it has been used, the results have been extremely encouraging from every standpoint.

It has already been noted that the shrinkage in volume of the material filled hydraulically, is far less than where the filling has been effected in a dry manner, which naturally means considerably much less subsidence on the surface. While surface subsidence is not entirely avoided with hydraulic filling, it is found to be hardly noticeable, while with hand filling, a distinct depression has always occurred. This work in France has been patterned, to a great extent, after the schemes carried on in the Silesian district, but here it is noted the filling is in conjunction with longwall, and not pillar work.

Gold and Silver Production in California

By CHARLES G. YALE.

The following statement shows the production, by counties, of gold and silver in California in 1907, as reported from the mines to the United States Geological Survey. This has been prepared and is presented in advance of the annual report on California forming a portion of the gold and silver section of "Mineral Resources of the United States, 1907," now in course of publication by the Geological Survey.

PRODUCTION OF GOLD AND SILVER IN CALIFORNIA, 1907.

County.	Gold.		Silver.
	Fine Ounces.	Value.	Fine Ounces.
Amador.....	102,370	\$2,116,182	20,477
Butte.....	134,813	2,786,840	13,587
Calaveras.....	53,114	1,097,974	82,454
Cotusa.....	36	734	12
Del Norte.....	42	878	4
Eldorado.....	15,440	319,177	3,486
Fresno.....	116	2,401	39
Humboldt.....	1,940	40,109	325
Inyo.....	2,769	57,241	67,333
Kern.....	42,512	878,798	130,353
Los Angeles, Orange and Ventura.....	542	11,214	16,767
Madera.....	644	13,303	767
Mariposa.....	19,616	405,498	6,288
Merced.....	401	822	15
Monterey.....	52	1,076	14
Mono.....	18,575	383,971	45,147
Nevada.....	104,591	2,162,083	26,522
Placer.....	23,354	482,772	5,088
Plumas.....	10,611	219,355	1,436
Riverside.....	186	3,836	40
Sacramento.....	38,263	790,973	3,082
San Bernardino.....	7,676	158,676	123,241
San Diego.....	361	7,455	53
San Luis Obispo.....	15	316	
Shasta.....	38,133	791,997	560,926
Sierra.....	23,409	483,904	3,971
Siskiyou.....	19,254	398,017	4,602
Stanislaus.....	163	3,364	42
Trinity.....	25,896	535,316	3,635
Tuolumne.....	39,033	806,876	9,778
Yuba.....	85,468	1,766,770	9,374
Total.....	809,214	\$16,727,928	1,138,858

A comparison with the statement for the previous year is as follows:

	1906.	1907.	Changes.
Gold, fine oz..	906,182	809,214 D.	96,968
Gold, value...	\$18,732,452	16,727,978 D.	\$2,004,474
Silver, fine oz..	1,220,641	1,138,858 D.	81,783

The decrease in gold production in 1907

was 10.7 per cent., and in silver 6.7 per cent. Taking silver at its commercial value in New York, the total amount of the precious metal production in 1907 was \$17,479,574, a decrease of 10.7 per cent. from the previous year.

Base Metals in the Transvaal

SPECIAL CORRESPONDENCE

The rate of base metal and mineral production in the Transvaal remains at a low figure; profits, if available for publication, would show a poor return for the great amount expended by hopeful speculators in recent years. Fortunately there are still many to be found whose faith in the future establishment of prosperous industries of this class—men who have bought their experience dearly and are determined not to miss the fruits of ultimate success. Government figures issued for June show that the half-year's yields total as follows in value: Copper, £10,224; galena, £11,501; tin ore, £43,694; flint, £6596; lime, £8148; miscellaneous, £26,949; making £107,112 in all.

The copper is drawn from the Messina in the northern Transvaal, which has installed a concentrating plant of small capacity for the treatment of the lower-grade ore. The most prominent tinfield continues to be the Rooiberg area to the west of Warmbaths; and seeing that the Zaaiploats State tin mine has resulted in failure with a loss of £4000 to the government, it is particularly gratifying to hear that satisfactory values continue to follow exploitation in various parts of the former region. Of the character of the lodes, whose presence is frequently marked by the workings of ancient miners, little was known till the other day, when Mr. Recknagel read a paper on the outcome of his lengthy investigations. The great variety of the occurrences is peculiarly noteworthy. There are, it is stated, fissures of small width, mere cracks with no vein filling except some clay; there are similar fissures with some irregular pockets of vein minerals attached; there are other fissures, two or three close together, including between them impregnated country rock; there are lodes with well defined walls, showing brecciated structure and inclosing vughs of large dimensions, and there are lodes which show both walls well defined over long distances. Gangue minerals are chiefly tourmaline, quartz, carbonates of iron and calcium, and orthoclase. With the cassiterite are found smaller quantities of pyrite, specularite, chalcopryrite, galenite, sphalerite and rarely gold.

At most mills on the Rand the pulp is divided for cyanide treatment into three classes—coarse sand, fine sand and slime.

The Pneumatic Coal Puncher

SPECIAL CORRESPONDENCE

As its name suggests, the Pneumatic coal puncher, manufactured by the Pneumatic Machine Company, Syracuse, N. Y., utilizes both electricity and compressed air in its operation; it is an electrically operated percussive tool. In its design is presented the culmination of ideas, which, from their conception, have differed radically from those formerly followed. The idea has been to combine within a single machine an electric motor for driving and the means for both compressing and utilizing the air. It was fundamentally recognized that the design of a tool of this kind must be such that the destructive effect of the vibratory motion of the working parts will not be

ESSENTIAL FEATURES OF THE MACHINE

The essential features of the Pneumatic machine may be thus briefly summarized: It is a self-contained machine combining electricity and compressed air. The blow is produced by air, expanding under pressure. The air utilized in striking the blow is compressed at each stroke of the piston. The piston compressing the air is operated by an electric motor; the latter is an inherent part of the machine. The separate piston on which the air acts, in order to produce the blow, moves in its forward motion independently of the compressing piston. Air cushions prevent shock to the machine. No hose or flexible shafts are required. Electric power is supplied directly to the machine through a cable. Is operated on the circuits commonly found in mines and industrial plants. Has exceptionally large

standard lines with particular reference to this machine, it presents features which insure the greatest simplicity and highest efficiency. The gearing by surprisingly simple means transforms the circular motion of the motor shaft into a straight-line motion for the operation of the piston rod. The space occupied is reduced to a minimum. The only unusual feature about the cylinder is that it contains two pistons instead of one. These pistons have no mechanical connection whatsoever.

OPERATION OF THE MACHINE

The pinion *B* on the end of the armature shaft *A* engages with the main driving gear *C*. Through the medium of the internal gear *F*, the crank pinion *E* and the crosshead *H*, the rotating movement of the armature is changed into the reciprocating motion of the piston rod *I* and



PNEUMATIC COAL PUNCHER IN OPERATION IN MINES OF THE BERWIND-WHITE COAL COMPANY, WINDBER, PENN.

transmitted to the electrical parts, and that at the same time the force of the blow must not be sacrificed in order that this may be attained.

The machine as perfected by the Pneumatic Machine Company, seems to embody all of the desirable features which have long been sought in a percussive tool electrically operated. By combining the well established methods of applying electricity with those of applying compressed air, the desired results have been brought about.

Flexible shafts, connecting hose, and the use of machinery entirely separate from that which does the work, have been eliminated. So also has magnetic force, which it is impossible to utilize in a manner sufficiently powerful to do the work, unless the weight of the machine becomes excessive. In the Pneumatic machine, the motive and working parts are self-contained, the blow being as powerful as that of the well known pneumatic tools, while its destructive effect is reduced to such a degree that the repairs are less than are required by any of the machines of the electric or pneumatic type now on the market.

capacity for work and small cost for repairs. Is giving satisfactory results in the hands of the ordinary labor commonly found about mines.

The extent to which the Pneumatic machine has been introduced has fully demonstrated its usefulness under all conditions of mining. In hard or soft coal, thick or thin veins, bad or good roof, rolling or level bottom and narrow or wide work, it has made excellent records. Its performance under these variable conditions has been such that it can justly be classed as a machine which is entitled to consideration as one of the most important factors in a coal-mining equipment.

All of the structural details of the machine are combined into one compact, self-contained machine, which is so constructed that it closely resembles the compressed-air punchers, which have been on the market for many years. The dimensions and weight are practically the same in both machines.

The motor, which is of the ordinary series-wound type, possesses no unusual features tending to make it complicated, or requiring special generators for furnishing current; but, being designed along

piston *J*. The latter, or rear piston, which is driven by the motor, compresses air on its backward stroke, the front piston *K*, with which it has no mechanical connection, follows simultaneously because of the vacuum produced by the recession of the piston *J*. Air is coincidentally admitted to the front side of piston *K* through the port *R*. On the rear side of piston *J*, the next to the motor, the air is compressed and just at the end of the stroke is admitted through large by-passes to the space between the two pistons. As a result, the front piston is forced forward exactly as in any compressed-air coal-cutter, but with the absence of valves. During this stroke, air is drawn into the cylinder behind the piston *J* through the main inlet valve *O*. On its forward stroke the air in front of the driven piston *K* escapes through the port *R*, but after the piston has passed and, therefore, closed the port, a sufficient amount of air remains to cushion the blow and prevent damage to the front cylinder head.

This cushion air may leak somewhat, and to prevent an insufficient supply remaining, which would have the effect of

producing a partial vacuum in this space and holding the front piston on the return stroke, a small inlet valve *R* is placed in the forward part of the cylinder to allow air to flow in under these conditions and before the open port is passed.

After the front piston *K* has made its forward stroke the rear piston *J* follows, mechanically driven as before, and would compress the air which has just made the stroke of the front piston and remains between the two pistons, but for the so-called vacuum valve *S*, which allows all air between the pistons above a certain pressure to escape to the atmosphere. The placing and action of this prevents the two piston faces coming together.

The piston diameter is $6\frac{1}{4}$ in., and it has been found that a final pressure of 95 to 100 lb. in the compressing end of the cylinder is right for operation, and the clearances have been proportioned for this pressure. The motor runs at three speeds under the control of the miner, giving, respectively 180, 160 and 140 strokes per minute to the reciprocating pick. It will be noticed that the speed of travel of the motor-driven piston va-

handle the machine to the greatest possible advantage, having perfect control over it at all times, with the assurance that each blow will have the desired effect.

A POWERFUL BLOW IS DELIVERED

The compressed air, in passing from the rear to the front of the compressing piston, flows through large, short ports. The tool-carrying piston instantaneously receives the full force of the body of compressed air and is driven forward at a high rate of speed which causes the pick to strike the coal with a powerful blow. The action of the air between the two pistons is such that a powerful pushing effect is introduced, which is maintained throughout the forward movement of the compressing piston. This action is beneficial in preserving the slow, powerful, penetrating qualities of the machine when working in soft coal and maintaining a powerful force behind the tool piston when working in hard coal.

With no moving parts in the blow-producing section of the machine, except the pistons, the adaptability of this apparatus

to a bore hole leading down into the mine. Pipes at the bottom lead to the worked-out places which are to be filled. The ashes are carried through these pipes and are piled into the abandoned "breast," or gangway, while the water seeps and drains away. When the new ash-pillars are large enough to be safe supports, the coal is taken out.

Flushing is a costly process. The piping is worn out rapidly by the sulphur which is always present in mine water and, therefore, has to be replaced frequently. The benefits of the system are more for the future than for the present. Owing to the rapid exhaustion of the richer and more easily mined veins, it is necessary to use all means, no matter how expensive, to make the remaining coal available.

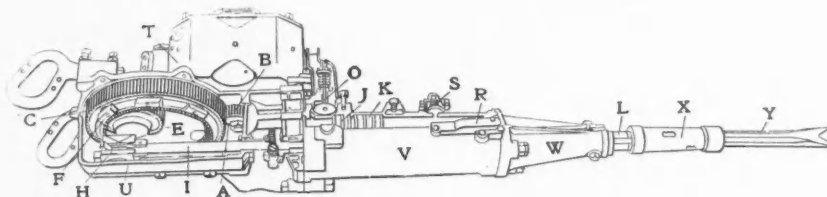
Underground Boring to Prove a Lower Coal Seam

At the Crown Pit of the Prestonhicks colliery in Scotland, the "great" seam of coal is worked beneath the Firth of Forth at a depth varying from 360 to nearly 600 ft. This seam is the topmost bed in the local coal series. It was recently found necessary to prove the under-seams so it was decided to put down a diamond-drill hole underground at a point 600 ft. below low-water mark. A position in the traveling-way, just opposite a narrow gangway connecting the traveling and haulage-ways, was chosen for the bore.

The road at this point was about 8 ft. wide and 10 ft. high; it was widened to 11 ft. for about 9 ft. in length; advantage was taken of the narrow gangway to the extent of 5 ft. in length. This made the place 16 ft. wide at the bore. The roof was raised 3 ft., and the pavement lowered 2 ft., the total height being 15 ft. just above the bore.

The "Wilson" type of diamond-drill plant was used for the work, and consisted of a 4-h.p. petrol engine, vertical boring carriage, ball-bearing boring bar and a double-acting Tangye pump, fitted with water-hose connections. The rods were lifted with a hand windlass. The engine could be run at uniform speed, which was an important advantage as the nature of the coal to be cut could not be determined previous to sinking the bore. The boring was done at the rate of 150 r.p.m. About $\frac{1}{2}$ gal. of petrol per day was consumed up to 300 ft. in depth, and from that quantity to 1 gal. per day at a depth of from 300 to 600 ft. The boring bar used was $7\frac{1}{2}$ ft. long. When the strata permitted, 6 ft. of cutting was done before it was necessary to disconnect the bar to add another rod. The bore hole was put down 601 ft. in 113 days.

One anthracite mine raises twenty-eight times as much water as coal from the ground.



THE PNEUMEELECTRIC COAL PUNCHER SHOWN IN DETAIL

ries from the maximum at the middle point of the stroke, to a minimum at the ends, a fact which equalizes the motor load. The weight of the entire machine is only 800 lb. The maximum power required for the operation of the Pneumeelectric machine never exceeds $7\frac{1}{2}$ horsepower.

THE POWER NECESSARY

As power is consumed only when the air is being compressed during the backward stroke of the motor-driven piston and during the control of the machine, that required of the electric motor is constant, regardless of the character of the material in which the machine is working. Thus the maximum amount of power to be provided for the operation of a given number of machines can be accurately determined, and when installed, leaves no danger of overloading on account of requiring more power than was calculated would be necessary to cut the coal. It is, therefore, unnecessary when estimating on power requirements in connection with the Pneumeelectric machine, to provide an excess for overcoming any possible deficiencies in estimates.

Inasmuch as the power for striking the blow is generated at each stroke of the machine and utilized in the cylinder in which it is developed, the operator can

to the severe requirements can be readily appreciated. Nothing to regulate, no moving parts to wear out, no complicated valve movement and the most simple construction, permit of the machine being placed in the hands of the labor commonly found about mines with the assurance of continuous and inexpensive operation.

Ashes for Pillars in Coal Mines

In some anthracite mines of north-eastern Pennsylvania ashes are being used as a flushing material, with which to fill the workings, so that safe robbing of the pillars may be carried on.

A mine just outside of Scranton, Penn., is near a big boiler plant which consumes three hundred tons of coal daily. Naturally, a large supply of ashes is created in the fire-boxes beneath the boilers. It is estimated that about fifty tons of ashes a day are sent down into the mine. Water pumped from a near-by mine is used for the flushing. Running through a wooden trough, the water reaches a tunnel that passes beneath the ash-pits. This tunnel slopes on a grade of $\frac{3}{8}$ in. to the foot. At intervals, the ashes are shaken into it from above.

The flow of water carries the ashes

The Decision on the Hepburn Law

The United States Circuit Court in Philadelphia on Sept. 10 filed its decision in the suits brought against six anthracite-carrying roads—the Delaware & Hudson, the Delaware, Lackawanna & Western, the Lehigh Valley, the Central of New Jersey, the Erie and the Pennsylvania—for violation of the so-called commodities clause in the Interstate Commerce law, commonly known as the Hepburn act. That clause provided that from May 1, 1908, it is unlawful for any railroad company to transport from any State, Territory or the District of Columbia to any other State, Territory or the District of Columbia, or to any foreign country any article or commodity—other than timber and the manufactured products thereof—manufactured, mined or produced by it, or under its authority, or which it may own in whole or in part, or in which it may have any interest, direct or indirect, except such articles or commodities as may be necessary and intended for its use in the conduct of its business as a common carrier.

The companies contested the suit mainly on the ground that the law is unconstitutional, and the cases were heard together. A similar suit brought against the Reading company was tried separately, because the defense was based on somewhat different grounds.

Opinions were filed by Judge Gray and Judge Dallas, both concurring. Judge Buffington dissented, but filed no opinion. The decision of the court is that the commodities clause is unconstitutional and void, for the reasons set forth in the opinion, and, therefore, cannot be enforced. The Government will take an appeal to the United States Supreme Court, but until a decision is reached there, the Circuit Court opinion will stand.

The decision, written by Judge Gray, is long, and goes over the questions submitted with great care. Its leading points are covered in the following paragraphs, which are quoted from the record:

"The fundamental and underlying question which presents itself at the threshold of all the cases is whether the so-called 'commodities clause,' so far as its scope applies by the universality of its language to the cases here presented, is in excess of the legitimate authority granted to Congress by the constitution.

"This question must be considered with reference to the constitution as a whole, and in relation to the concrete facts of the several cases."

"It appears," the opinion continues, "that enormous sums have been expended by the railroads to enable them to mine, prepare and transport coal.

"This situation is not a new one, created since the passage of the act in question, but has existed for a long period of

years prior thereto, and the rights and property interests acquired in conformity to the constitution and laws of Pennsylvania, and their rights had never been questioned by the courts or people of the commonwealth, but recognized and protected."

"Congress, of course, is vested," continues the opinion, "only with such legislative powers as are specifically enumerated in the constitution, together with such as are necessary and proper to carry the same into execution, and it is admitted that, if constitutional sanction exists for the passage of the law in question, it must be found in that clause of the constitution which declares that Congress shall have power to regulate commerce.

"Counsel for defendants contend that the commodity clause was not a valid exercise of that power. Fully realizing the responsibility that is imposed upon the court, we turn to this question.

"We think it may be safely said that no assertion of this power hitherto by Congress has been so far-reaching or affected in so serious a degree individual liberty and property rights enjoyed under the constitution and laws of a State.

"It is not to be denied that the right to carry coal in interstate commerce was, until the passage of the act in question, a lawful right of these defendants; that it was a common right of property, neither denied nor disputed by the common or statute law of Pennsylvania; that it was a most important property right, the enjoyment and exercise of which was neither criminal nor immoral, and subject only to any restraints imposed upon its possessors by the common or statute law of the State or by the then existing statutes of the United States, so far as they were engaged in interstate commerce.

"That this legislation is drastic and harsh does not, of course, dispose of the question of power on the part of Congress to enact it. The first inquiry to be made, therefore, is as to whether this legislation is a regulation of commerce within the true meaning of the commerce clause of the constitution. * * * *

"In the opinion of this court, the enactment in question is not a regulation of commerce, within the proper meaning of those words, as used in the commerce clause of the constitution. It seems perfectly plain that Congress cannot deprive any person of liberty or property without due process of law.

"Counsel for the Government, however, contend that any enactment of Congress which purports to regulate commerce and which actually does control, restrain or prohibit, is such an exercise of power as is subject to no limitation whatever. In other words, if it be on its face a regulation of commerce, no right of personal liberty or property can stand in the way of its enforcement. * * * *

"The constitution of the United States was intended for the common understand-

ing of the people. Life, liberty and property are ranked together under the protection of the fifth amendment, and by the exigencies of its command a person can no more be deprived of his property than he can be deprived of his life and liberty without due process of law.

"The facts set forth in the several answers of these defendants show that no right of this property is so valuable as the right to transport it over their own roads. The coal is so situated as not to be capable of transportation without enormous loss by other roads. The exigencies of the act will compel the defendants to cease mining and transporting, while still retaining ownership, to the incalculable injury of great populations, or they will be compelled to divest themselves of title by a compulsory sale. * *

"It is to be observed that the act is in a certain sense retroactive. It affects property lawfully acquired long prior to the date of its enactment.

"From every point of view from which we have been able to approach the question, the unreasonableness and consequent invalidity of the commodity clause is apparent.

"It invades the rights of the State by striking down the liberty hitherto innocently enjoyed by its citizens, and deprives these defendants of their property contrary to the letter and spirit of the fifth amendment of the constitution.

"If the enactment in question be warranted by the commerce clause of the constitution it is hard to see what bounds may be set to the exercise of that power. It will indeed be an open door, through which the forces of a centralization hitherto unknown may enter at will, to the overthrow of that just balance between Federal and State power for which the makers of the constitution so wisely provided as an essential to the preservation of our dual form of Government.

"We confine ourselves to the concrete facts presented by the pleadings in these cases, and intimate no opinion either way as to cases where property has been acquired by the carriers subsequent to the passage of the act. For the reasons stated, therefore, these bills in equity are dismissed and the petitions for writs of mandamus on the law side of this court are denied."

The tin production of New South Wales for 1907 was valued at £293,305. This increase in production over that of 1906 is due to the increasing output from dredges. Tingha is the main producing center; 28 dredges are operating in that district.

Two of the stamp batteries at the mill of the Luipaards Vlei Estate are equipped with five stamp cam-shafts. These are employed in order to use up cam-shafts broken on the 10-stamp units.

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The Conservation of Resources

The schedule of investigations adopted by the National Conservation Commission is in general a carefully considered plan, that will be of much benefit even if but partially executed. Indeed, the plan is so ambitious that it is impossible to expect that all of the inquiries will be answered.

Referring to the question of minerals, which interests us most, it is possible to make a rough approximation of the country's resources in coal, lignite and iron ore, but the determination of the reserves of oil, gas, and other ores is beyond the ability of all of the mining engineers and all of the mining geologists together. The dowser, or the electrical mineral indicator, who can really find ore, has not yet appeared; nor the man who can see into the ground.

The nature and extent of waste in the mining and use of mineral products, and methods of preventing or lessening the waste are good subjects for inquiry; also the more complete utilization of by-products and increased efficiency in the use of all products. But the answer to these questions is simple, viz., encourage the reading of the technical journals.

We venture to correct an academic misapprehension. Americans are commonly considered to be wasteful; this probably is the idea in Washington. We think that Americans are wasteful in some respects, but in others are paragons of economy. As consumers, we are prodigal of our wealth and scandalously wasteful; as producers, our utilitarian ideas lead us to be egregiously economical. Who does not know the captain of industry who is a skinflint in his factories, and a spendthrift in his home or his club?

It is important to define what is waste. Practically we prefer to accept the unphrased definition of the operator in the field rather than the words carefully formulated by the professor in his cabinet or laboratory, because the operator has learned to appreciate many things that the professor generally fails to consider. There is much apparent waste which in reality is not waste at all. For example, remark is frequently made of the immense quantity of sulphur which is thrown away in the treatment of sulphide ores; but it is not considered that the only use for such sulphur would be the manufacture of sulphuric acid, and that most of it is

thrown away in parts of the country where there is no market for sulphuric acid, nor probably will be for a time more distant than we can clearly see ahead. If the ores were reserved for an indefinite time, interest charges would overwhelm them.

In all considerations of waste, the position of capital must be held prominently in mind. Resources can be reserved if capitalization be postponed until they are within the safe margin of profitable activity, their aspect until that time being as having no relation to commerce, just as if they were undiscovered treasures of nature. Otherwise, they would be saddled with colossal accumulations of interest, to avoid which wasteful exploitation would be compelled.

This is directly in line with many of our apparent wastes. For example, regenerative furnaces have never found so wide application in the United States as in Europe. The reason is that coal is dear in Europe and comparatively cheap in the United States; in the United States the saving of fuel, immense though it be, has not been sufficient to pay the interest and fixed charges upon the greater capital required for the plant. As coal increases in value, this condition will change. Engineers have long been conversant with the increased economy of gas engines, but for a long time they did not come into extensive use because the charges on greater cost of plant offset the apparent advantage in direct operation; as the cost of plant has been reduced, gas engines have come more extensively into use.

So it is through our whole line of industry. Only 15 years ago we used to deplore that the United States possessed no chemical manufacture worth mentioning, save the rudimentary. So recently as that the time was not ripe for its development. But since then we have seen the growth of an immense chemical industry, utilizing by-product after by-product. This is something that our inventors and manufacturers may be relied on to attend to. A Gayley requires no artificial stimulus to increase the economy in making pig iron, nor does he need the efforts of a Federal commission to point out to him that there is a chance for effecting economy in that art.

Producers and manufacturers, with the aid of engineers and their other expert assistants, are aiming all the time to realize the most possible money from their

resources. The improvements of specialists in the respective arts are sooner or later communicated to the technical periodicals and the transactions of the engineering societies, whereby the knowledge is disseminated through the whole industry. Consequently, as we said above, the simple answer to these inquiries of the National Conservation Commission is the encouragement of the reading of technical periodicals. The self-interest of the producer is in the direction of economy; if his immediate interest be different from that of posterity, capitalization must be prevented.

On the other hand, as consumers Americans are shockingly wasteful. This must be recognized immediately by every investigator, and herein it appears to us is the great field for the National Conservation Commission. We disgrace ourselves by our needless sacrifice of life and limb. We waste enormously in building by uneconomical methods. We suffer annually a gigantic loss through the destruction of property by fire. We burn our coal wastefully both in factory and in household. Our people are extravagant in their food and their clothing, not in using good things, but because they deliberately throw away a large part of what they buy. If Americans were as economical as the French, the wealth that this country would attain would surpass all belief. It is economy in living that has made the French people the bankers for the world.

The Decision in the Anthracite Coal Road Cases

The decision announced by the United States Circuit Court in Philadelphia last week, in the suits brought against several anthracite-carrying railroads, is of importance to many carriers of coal besides those immediately concerned in the case. The suits were brought to recover penalties for violation of the so-called "commodities clause" of the Hepburn amendments to the Interstate Commerce law. This clause provided that no railroad engaged in interstate commerce should carry any commodity—except lumber—which it owned, or in the production or sale of which it was interested; exception being made only of materials required for the operation of the road. The legislation was drastic in its nature, providing heavy

penalties for violation of its terms. While the act was general in its terms, it was evidently aimed at the ownership or control of coal mines by railroad companies, which had grown to be common in many parts of the country. In some cases this control had grown out of a desire to secure and protect the traffic of a railroad and prevent losses by competition; in others the railroads had been built to serve the coal mines and the ownership of both was common.

The commodities clause took effect May 1 last. In anticipation of that date a number of railroad companies took steps to divest themselves of the ownership of coal mines. Thus, for instance, the Baltimore & Ohio sold the stock which it held in the Consolidation Coal Company; the Rochester & Pittsburg transferred its stock holdings in a subsidiary coal and iron company; and several railroad companies in Indiana and Illinois took similar action. The anthracite carriers, however, decided to contest the law, partly because they believed they had a strong case, but more because the ownership of mines and railroads was so involved that it would be impossible to separate them without an entire reorganization of the companies.

Immediately after the date when the law took effect, the Federal authorities took steps to enforce it, the cases of the anthracite roads being selected because they were the most conspicuous offenders. Suits were brought against seven companies, and six of these cases were tried together, that against the Reading having a separate hearing, because the defense was based on different grounds from the others. The six companies, in their answers, rested generally on the claims that the act exceeded the powers vested in Congress for the regulation of commerce between the States; that the act was discriminatory in its nature, as it excepted certain commodities; and that their right to mine and carry coal was protected by special charters. There were minor claims made in the pleadings, but those named were the important points. No contest was made on the facts, which were readily admitted by the defendant companies. It was entirely a law trial, and was argued before a full bench—Judges Gray, Dallas and Buffington—two at least having a wide reputation as jurists of long experience and high standing.

The decision rendered—a summary of

which is given on another page—is wholly in favor of the companies, and disposes of the commodities clause entirely, unless the Supreme Court should reverse it later. The court, in its opinion, bases its decision entirely on the constitutionality of the law, the other points made by the defense being hardly considered. It holds that the legislation exceeded the powers of Congress under the Constitution, and that it sought, or would lead to, the practical confiscation of important property rights, without that "due compensation," which is required. It holds, therefore, that no penalties can be imposed, and the defendant companies are free to continue their traffic as before.

Cost of Producing Copper

The article by Mr. Townsend, published elsewhere in this issue, is in line with the series of articles by Mr. Finlay, which we have been publishing, and articles by other contributors on the cost of production. On this important subject we have presented during the current year information and data, unique in technical literature, that will be of importance in considering the financial aspect of mining and smelting enterprises.

Mr. Townsend has recognized the basic principle that the report of a stock company for a single year is inconclusive, and indeed may be misleading, but in assembling the reports of the same company for a series of years the truth is likely to appear. There is always a great temptation to managers to deceive themselves respecting the item of construction, which may be charged to capital account, but as Mr. Townsend lucidly points out, such charges are constantly recurring, and it is safest to charge construction to regular operating expense.

Mr. Townsend's article is an important contribution to an important subject, and may be profitably studied. Such an investigation and presentation of data involve an immense amount of work, far more than appears from a casual inspection of the finished product. The tabulation of such figures is not a thing that can be lightly intrusted to clerical assistance, but must be done by the author himself, or under his very close supervision. The figures given in Mr. Townsend's article have been carefully checked, and we believe they are correct.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

How To Sell a Mine

Mr. Rogers presents in the JOURNAL of Sept. 12 an interesting article in criticism of an editorial in a previous issue of the JOURNAL, but it does not seem to me that there was really anything to criticize. Obviously, the editorial was pointing out nothing but the bare outlines of the method to be followed. It goes without saying that the person who desires to sell such a property ought to be able to furnish a lucid and intelligent statement of the essential facts respecting it. We all know, as Mr. Rogers says, that one of the reasons why it is so difficult to interest capitalists in a mining venture is the inability of the vendor or promoter to make an accurate statement of the facts that are open to common observation. Many reports by *soi disant* mining engineers are no better. I have a recollection that this subject was fully discussed in an able editorial in the JOURNAL of a few years ago.

Mr. Rogers has given us a valuable article, containing a lot of new ideas, and I am sure that many readers of the JOURNAL welcome contributions from his pen upon this and allied subjects. However, the editorial in the JOURNAL of Aug. 29 was directly to the point. I hope that this will stimulate other readers of the paper to contribute their views and experiences.

WILLIAM T. MURRAY.

New York, Sept. 8, 1908.

[The editorial on mine reports, to which our correspondent refers, appeared in the JOURNAL of Aug. 18, 1906.—EDITOR.]

The Cost of Silver-lead Smelting

The article by Mr. Ingalls on the cost of silver-lead smelting, in the JOURNAL of Aug. 15, will be read by mining men with much interest. As a study of the American Smelting and Refining Company, a concern more often abused than praised, the article is a commendable attempt at treating a live subject from an impartial and conservative standpoint. From the point of view of an ore producer, however, the title of the article itself and the headline crediting the company with a profit of \$2 per ton of ore smelted, both seem open to criticism as stopping short of the mark, as being too moderate in view of the information, or rather lack of information, in the company's reports.

SMELTING COSTS

The costs of smelting, as Mr. Ingalls approximates them, range from \$0.90 to

\$1.37 per ton higher than the average costs indicated by census returns¹ covering operations in this country for the calendar year 1904.

According to the census, there were 32 establishments in the United States actively engaged in the smelting of lead ores, of which 19 were engaged in treating silver-bearing products. Seven of the 19 smelters did both smelting and refining, and are classed as refiners, making 12 establishments engaged in the smelting only of silver-lead ores. The bulk of the smelting of silver-lead ores centered in Colorado, Utah, Washington, Texas, and Montana, in the order named.

Unfortunately, the census data on lead smelting have been made intricate by being lumped together, Missouri being the only State whose returns are shown separately. But inasmuch as only non-argentiferous ores, commonly called "soft lead" ores, are smelted in Missouri, the returns from this State give a set of averages which may be applied to the ore tonnage of soft-lead smelteries elsewhere as a basis for estimating costs, and we are finally able to tabulate two sets of statistics, one set relating to the smelting and refining of silver-lead ores, the other set relating to the smelting of soft-lead ores. The figures for silver-lead ores appear here as Table A.

TABLE A. COST OF SMELTING AND REFINING SILVER-LEAD ORES AND PRODUCTS IN THE UNITED STATES, 1904; TOTAL 19 ESTABLISHMENTS; TONS OF ORE, 2,271,724.

	Total Expense.	Cost per Ton of Ore.
Salaried officials, clerks, etc.	\$760,523	\$0.335
Wages	4,936,284	2.173
Rent of works	1,200	0.001
Taxes	104,541	0.046
Rent of offices, interest, insurance and all sundry expenses not hitherto included	669,110	0.295
Contract work	20,561	0.009
Materials for smelting:		
Ores (2,271,724 tons)	53,934,731	23.741
Fluxes (461,894 tons)	577,305	0.254
Fuel	2,762,265	1.216
Rent of power and heat	27,366	0.012
Mill supplies	28,363	0.012
All other materials	2,316,796	1.020
Materials for refining and desilverizing:		
Doré bars (13,147,523 Oz.)	31,722,604	13.964
Domestic base bullion (239,836 tons)	49,883,791	21.959
Foreign base bullion (97,179 tons)	17,677,246	7.781
Fuel	772,297	0.340
Mill supplies	36,041	0.016
All other materials	1,798,603	0.792
Freight	163,969	0.072
Total expenditure (excluding ore, doré bars and base bullion bought)	\$14,975,224	\$6.593

¹Department of Commerce and Labor, Bureau of the Census. Bulletin 86, Census of Manufactures, 1905: Copper, Lead, and Zinc Smelting and Refining.

A further view of the subject of treatment costs is afforded by the same census bulletin, in a table in which the data pertaining to lead smelting and refining are rearranged so as to give two sets of figures, one set relating to plants where smelting only is carried on, the other set relating to plants doing refining as well as smelting. By using the set of figures relating to smelting, and then deducting all items relating to the soft-lead branch of the industry, as we have previously arrived at them, we obtain an estimate of the number of tons of ore treated and the working costs of the 12 establishments engaged in the smelting only of silver-lead ores. This estimate appears here as Table B.

TABLE B. COST OF SILVER-LEAD SMELTING IN THE UNITED STATES, 1904; NUMBER OF ESTABLISHMENTS, 12; TONS OF ORE, 2,122,462.

	Total Expense.	Cost per Ton of Ore.
Salaried officials, clerks, etc.	\$427,599	\$0.202
Wages	3,612,529	1.702
Miscellaneous general expenses (taxes, rent of offices, interest, insurance, etc.)	433,859	0.204
Materials for smelting:		
Ore, 2,122,462 tons	45,499,745	21.388
All other materials	3,823,389	1.801
Total expenditure (excluding ore bought)	\$8,297,376	\$3.909

The average cost of smelting obtained in Table B leads to the suspicion that the average for refining and smelting, shown in Table A, is too high, and that the items in Table A, entitled "All other materials," call for further explanation before being finally placed among the working costs. As likely as not, these doubtful items include products bought for treatment, but not classed as "ore," doré bars, or "base bullion." In any event, we find that the costs in Table A are increased by the cost of refining some 97,179 tons of foreign base bullion, one item to be eliminated before weighing these averages very closely.

In attempting to use the census data as a side-light on the American Smelting and Refining Company, we must bear in mind that the operations of that company are not limited to the United States, but extend into Mexico, also that the company smelts some ore on a copper base. We are in the dark as to the tonnage smelted in Mexico, but the bullion output credited by statisticians to that country does not indicate a sufficient ore tonnage in comparison with that of the United States to vitiate the foregoing averages.

SOURCE OF PROFITS

Mr. Ingalls' conclusions are summed up

in such a way that the reader is apt to get an idea that the profits of the American Smelting and Refining Company have been derived from side issues more than from the profits on ore smelted, and that the business would not be profitable to any concern not prepared to conduct operations on the same extensive scale.

According to the census, the 32 establishments occupying the field of lead smelting during 1904, were distributed as follows: California, 1; Colorado, 7; Idaho, 1; Illinois, 3; Iowa, 1; Kansas, 1; Missouri, 8; Montana, 1; Nebraska, 1; New Jersey, 2; Pennsylvania, 1; Texas, 1; Utah, 1; Washington, 2; Wisconsin, 1; total, 32. The 32 establishments are credited with a combined capital of \$63,822,810, as follows: Land, \$2,958,080; buildings, \$18,628,976; machinery, tools and implements, \$20,941,814; cash and sundries, \$21,293,940; total, \$63,822,810.

The average ore producer in the West is obliged to dispose of his ore to a custom smelter. So long as the American Smelting and Refining Company had a monopoly of the custom-smelting business it could buy ore on its own terms, from which there was no appeal. Many producers are hostile to the company because they believe it has exacted extortionate profits. If they could be convinced that the company's profit is only \$2 per ton of ore, they would feel better. It is only the occasional mine that pays its way, and the owner of a paying mine is so often interested in other mining properties that have not yet been brought to the point of profit that he is inclined to look upon mining as an "up-hill game" at best. On the other hand, he does not see the ore buyers taking many risks. He sees the profits of the Smelting company growing larger year by year, immense dividends paid, new plants built, old plants enlarged or remodeled, a large surplus created—all coming indirectly if not directly out of the profits on ore smelted—and he is unable to divide the probable tonnage handled by the company into its total net earnings without being convinced that the margin of profit per ton of ore is more than ample.

According to the estimate of Mr. Ingalls, the smelters and refineries owned by the American Smelting and Refining Company must be worth in the neighborhood of \$15,000,000. Adding this sum to the items shown on the company's balance sheets as "Investments," "Metal stocks," "Material and supplies," "Cash and cash items," the ore producer computes the live assets to be less than half the sum for which the company is capitalized; his computation is verified, in a way, by figures such as those of the census; his memory goes back to the company's beginnings and he wonders what invisible assets swell the company's capital on its books and enable it to pay such large dividends on its preferred and common stock.

COMPLAINTS OF ORE PRODUCERS

The ore producer who sells ore to a smelting company has become accustomed to getting pay for less quantities of metals than are indicated by assay, deductions having been made for what he believes to be metallurgical losses. He has also become accustomed to being allowed lower prices for metals than those ruling in the wholesale markets of the country, deductions having been made for what he believes to cover freight or bullion, refining costs, selling commissions, etc. The deductions so made by ore buyers have always been more than ample, but no two ore buyers use exactly the same schedule, neither does any concern adopt the same schedule in dealing with all patrons. It is plain that smelting costs, metallurgical losses, freight on bullion, refining costs, interest, depreciation, profit, etc., must all be borne by the ore in some way; but by the subterfuge of deductions, a little on one metal here, a little there, and a little somewhere else, the ore buyer is able to bring the treatment charge which attracts most attention from the producer to a low point. Among complaining ore producers, the most bitter are those who market gold ores, one reason being that with no valuable metals in the ore, besides gold, there is little chance for round-about figuring, and the treatment charge stands out prominently in comparison with the treatment charges applied to ores containing other metals where a portion of the smelter's margin comes through the little deductions already mentioned.

COMPETITION

For a long time, ore producers were in the dark as to ordinary metallurgical losses and as to the ordinary costs incident to handling the smeltery output until this is finally delivered to consumers in the form of refined metal. Mr. Ingalls has done much to throw light on these subjects. A study of these features, in connection with a study of the cost of smelting different kinds of ore, is leading a few ore producers into erecting smelting plants of their own. By buying outside ores to smelt with their own, they are becoming active competitors of the American Smelting and Refining Company. The latter company, on the other hand, is getting into the control of mines.

With a number of concerns in the country, each handling silver-lead products through the different stages from mine to consumer, the rivalry is bound to be interesting and must be of permanent benefit to the mining industry throughout the West. In any event, the smelting business hinges so closely on the development and operation of metal mines that no concern can hope to monopolize the field permanently.

GEORGE W. RITER.

Salt Lake City, Utah, Aug. 28, 1908.

[We are unable to find in Census Bulletin No. 86 the figures which Mr. Riter

gives, his figures being evidently modified from its table No. 33. This table is such a jumble of the business of smelters and refiners, treating argentiferous and non-argentiferous ores, that we confess our inability to unravel it or make any extensive deductions from it. Anyway we should not think seriously of undertaking to deduce costs from a census report. Cost is an elastic term, and a precise use of it requires a definition as to whether (1) a partial cost, or (2) the whole, or real, cost is meant. Many managers deceive themselves in regard to the real cost. Mr. Ingalls was distinctly discussing the real cost of smelting, refining, etc.

The construction of new smelting works does not necessarily imply a re-investment of profits, but rather may represent a direct part of the cost of production, the depreciation of older plants being taken care of in this way. Indeed, a concern which expects to continue in its business must thus keep up its property and earning capacity. The American Smelting and Refining Company during the nine years of its existence has abandoned its Germania works, Grant works, Philadelphia works, Kansas City works, and perhaps others that we do not think of now. This does not include the many plants that were dismantled immediately upon the organization of the company. A new plant has had to be built at Murray, Utah, and the works at El Paso, Texas, and Leadville, Colo., have had to be practically rebuilt.

The worth of a business is not represented by the physical value of its plants, inventories, cash, and other tangible items. Business experience, good-will, or whatever it may be called, commands a large price. It seems to be inevitable that a new company entering a business must experience delays, disappointments and losses. At great expense an organization is perfected, the business is learned and profits begin. The ability to earn profits is properly capitalized.—EDITOR.]

The Temagami-Cobalt Mines, Ltd.

Not long ago we referred casually in an editorial to the operations by amateurs in mining. An apt illustration of their methods has recently come to our attention in the form of a letter by Julian Hawthorne, the well known novelist, son of a more distinguished father. This letter was addressed to a member of our staff, whose name and address evidently had been secured from the catalog of his Alma Mater. Mr. Hawthorne's letter is as follows:

New York, August 21, 1908.

My dear Mr. X...:—

It is a serious thing—this that I am doing now.

After following a profession for nearly forty years—reaching the point where he really has command of his instrument and can make it produce what he will—

and when he is getting more than ever before for what he produces—then it is a serious thing for a man to turn from that work and undertake something totally different.

And the inducement must be strong that makes him quit the work that he knows like an old shoe, and take a job which is unfamiliar.

But that is what I am doing.

I have dropped literature, and taken up the development—and the exploitation—of a mine.

It had to be a good mine to turn me from my past life's work to this work. And that it is good—none better—is the conviction of myself and my associates, mature, hard-headed men of the world, who know that, in business, a mistake is a crime.

It is a conviction based, not on guess-work or enthusiasm, or even on personal knowledge derived from a year's investigation and development of the property; for men naturally think well of what has been paid for with their money, and holds their expectation of fortune;—but our conviction and confidence have a yet sounder basis. We hired professional experts, whose reports confirmed our highest anticipation; and then, on top of that, experts, employed by our rivals in business, who had heard of Temagami, came back with such tales as induced our rivals to come to us and offer to buy us out on very tempting terms.

We could have sold Temagami again and again to these customers, and made a fair fortune out of the deal. But we turned down these offers because we mean to keep Temagami for ourselves; to dig our fortunes out of it, and live on our dividends; and the only reason we now come to you is, that we have spent in the purchase of additional property all the money we can at present afford, and a small sum is needed to get to work promptly turning out our ore.

That is the sum of my message to you, but I will add a word or two.

When we decided to offer this stock to the public, question arose as to how it might best be done. There was the usual way of doing such things; and there was another way. The usual way was, to hand it over to a broker, and let him exploit it in the broker's style; for doing which, we would have to pay him exorbitant charges. But none of us is a rich man; we are a group of private persons, more or less well off, and though we would not be "penny wise and pound foolish," we aimed to be economical where we wisely could.

So I suggested the other way. Here is my argument. "I happen to be the only one of us, whose name, advertised through my connection with literature and journalism, is widely known. I know how to write. I was also educated as an engineer, and practiced for some years; but that is not important. I am one of

the Company, and for what I may do in its behalf, I shall have no broker's fees to charge. Let me write the letters to accompany our prospectus. One of the main difficulties in the way of the ordinary prospectus is, to induce people to whom it is sent to read it; in nine cases out of ten it goes unread into the wastepaper basket. But a letter written by me and with my name signed to it, will attract the attention of curiosity,—“What can Hawthorne, the literary man, be doing with a mine?” That curiosity may save our prospectus from the waste-paper basket in five cases out of the nine. And if that be accomplished, our battle is half won; for nobody who reads our prospectus, and realizes what it means, will feel that he can quite afford to ignore it.”

That was my idea, and it prevailed, with the result which is before you.

The silver mines of Ontario, in Canada, are famous, and are probably known to you; in the last four years they have proved to be the greatest and quickest producers in the world. Our property has an area of 840 acres right in the thick of the productive region. Its surface indications are identical with those of the best of its neighbors, and the assays of its ore are so attractive that it is almost imprudent to publish them.

Read our prospectus, which tells the truth, as seen by a man who knows his business; and if you require any further information, address yourself to me.

In conclusion,—because my name is prominent in this announcement, don't get the notion that I am prominent in our Company, or that Temagami's excellence is to depend on my say-so. All I have, I have invested in the enterprise; but my all was not much. But I am a writer, and was chosen to do this part of the work. I may hope, hereafter, to return to literature, and to write certain things which I have had no leisure to write in the past; but that is neither here nor there. I am a miner now; and shall stay so till Temagami has done all that we expect from it. That is all.

Sincerely yours,
JULIAN HAWTHORNE.

The prospectus accompanying the above letter states that the Temagami-Cobalt Mines, Ltd., is incorporated under the laws of Maine, with a capital of \$3,000,000, divided into shares of \$1 each, \$1,000,000 of the capital stock being in the treasury. The board of directors consists of eight, including Woodford W. Brooks, of New York, as president, and Julian Hawthorne. Among the other six directors there are some fairly well known names, but among the eight directors there is not one person whom we recognize as being experienced in mining, either practically or financially.

The prospectus is a document of generalities after the time-honored fashion of the amateur. Pages 1 and 2 contain a reprint from a newspaper, describing the

Cobalt district, from which the Temagami-Cobalt mines are 19 miles distant. The remaining six pages of the prospectus consist of a letter by Woodford W. Brooks addressed to Mr. Hawthorne, this letter beginning “You requested me for a statement, so here it is. It is longer than most people like to read, but as you will see, I had considerable ground to cover. While I am addressing this to you, it will be evident that it is meant for your friends whom you are desirous of interesting in our project.”

For two pages and three-quarters, Mr. Brooks describes the Cobalt district, incidentally touching upon the spectacular history of the Hudson Bay Company. Near the bottom of his third page, he states that just a year ago, himself and associates became interested in 240 acres of land within three miles from Temagami station. “We hardly started exploring our ground when we discovered stupendous values.” Additional acreage was then acquired, the total now being 840 and as usual great emphasis is put upon the value of so large a tract of land.

“When you consider” says Mr. Brooks, “that in the 40 acres of the La Rose mine they now have something like 8,000,000 oz. of silver blocked out, you will, I know, realize what I am driving at.” Then follows some examples of assays. The nearest that Mr. Brooks comes to describing his mines is as follows: “We have done considerable work on these properties, many of the veins we have stripped, we dug trenches, sunk shafts, and wherever we have worked, we found values. But we have not arrived at a point where the orebodies can be measured up, and not until that point will have been reached, can we tell with certainty what the values will average. . . . We are justified in stating that some of our claims at least, will develop into wonderful producers, But we have not yet arrived at a stage where we can make specific statements. We are not as yet producers or shippers. We know simply that every one of our claims is mineralized, and the veins are outcropping in all directions. We are now developing them, and we believe that our expectations will be fully realized in three, or four months.”

The company is offering 200,000 shares at 30 cents per share. The prospectus is not accompanied by the report of any engineer or mining geologist. Nor is there any evidence that the promoters of the company have ever secured professional advice.

This enterprise is a good example of an amateur venture in mining. It is too bad to see Mr. Hawthorne lending his name, nay giving his name, and prostituting his pen to induce his friends, acquaintances, and those who know him by name to put their money into a mining property, about which nothing of consequence can be said in an 8-page prospectus.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

J. R. Finlay, mining engineer, of New York, has gone to the West on professional business.

Robert K. Painter has returned to New York after a month spent in examining mines in Nevada.

J. Parke Channing, president of the Tennessee Copper Company, is visiting the mines and works of that company.

J. B. Hogg, of Connellsville, Penn., has been appointed mining engineer at Boswell, Penn., for the Merchants' Coal Company.

William S. Mann, general manager of the Boston & Oaxaca Mining Company, Tlacolulu, Oaxaca, Mexico, has gone to Boston on business.

Isaac Guggenheim, treasurer of the American Smelting and Refining Company, has returned to New York from a short trip to Europe.

W. T. Lewis, who has just been appointed State labor commissioner of Ohio, was for a number of years a coal miner, but is now a lawyer.

J. E. Spurr, with a corps of six assistants, is engaged in a thorough topographic and geologic survey of the properties of the Campbird mine, at Ouray, Colorado.

G. A. Denny, of London, well known for his work in the Transvaal, arrived in the City of Mexico recently. It is understood that he expects to make a long stay in Mexico.

J. W. Johnson, of the firm of Johnson & Enos, mining engineers, of Mexico City, has returned to that place from Arizona, where he has been some time on professional business.

Edwin C. Luther has resigned his position in the engineering department of the Philadelphia & Reading Coal and Iron Company, to take charge of the coal-mining interests of the Shaeffer estate.

Anson W. Allen, for 20 years past with the Pencoyd Iron Works, Pencoyd, Penn., has been appointed superintendent of the open-hearth steel furnaces of the Tennessee Coal, Iron and Railroad Company, at Ensley, Alabama.

Carl Graul, who has been chemist for the Semet-Solvay Company, at Dunbar, Penn., has been appointed superintendent of the new by-product coke plant erected at Charlotte, Ill., by the United States Steel Corporation.

Godfrey D. Doveton has joined the staff of Spurr & Cox, Inc., as metallurgical engineer, and will be exclusively associated with that organization. Mr. Doveton's address for the present will be the Mexico City office of Spurr & Cox.

J. V. Allen has been elected secretary of the Alabama Coal Operators Association, and will perform the duties of chief commissioner. His office will be in the Brown-Marx building, Birmingham. The association represents 95 per cent. of the coal production of Alabama.

Arthur C. Terrill, for the past two years professor of mining and metallurgy at the University of Oregon, has been appointed professor of metallurgy at the University of Idaho. Professor Terrill recently returned to Oregon from a trip to Seattle, Tacoma, and the Cœur d'Alenes.

Thomas A. Keighley, general manager of the coal mines and coke ovens of the Shenango Furnace Company, at Wilpen, Westmoreland county, Penn., has resigned, and gone to West Virginia, where he has accepted a similar position with a concern in which his father, Fred Keighley, is one of the principal owners. A. K. Renwick has been appointed to succeed to the position vacated by Mr. Keighley, and assumes his duties at once.

Obituary

Joseph Bell, one of the pioneers in the iron business in the Wheeling, W. Va., district, died in that city, Aug. 31, aged 89 years. He entered the iron business in 1850, and was connected with various concerns. He was one of the original organizers of the Wheeling Steel and Iron Company, and a director until he resigned owing to old age.

Gardner Dexter Hiscox, a well known writer on scientific subjects, died Sept. 13, at his residence in East Orange, N. J., after a short illness. He was born in Elizabethtown, N. Y., 86 years ago, and although without college training, devoted his life to scientific work. He was best known as the author of "Compressed Air and Its Application," "Modern Steam Engineering," and "Hydraulic Engineering."

Capt. Enoch Roberts died recently in Ishpeming, Mich., aged 73 years. He was born in Cornwall, England, and came to the United States when 25 years old. After a few years in the copper country of Lake Superior he was made mining captain for the Collins Iron Company, at Ishpeming. Since then he had held important positions on several large mines on the Marquette and Menominee ranges. He retired from active work about a year ago.

Charles K. Lord, who died in Philadelphia, Sept. 10, was born at Hoosick Falls, N. Y., in 1846. He served on various railroads, and was connected with the Baltimore & Ohio for 16 years. In 1896 he was chosen president of the Consolidation Coal Company, of Maryland, and held that office until his death. He was largely interested in Nevada mines, and for two years past was vice-president

of the Tonopah Mining Company and president of the Tonopah & Goldfield Railroad Company.

Thomas M. Richards, who died in Philadelphia, Sept. 5, aged 73 years, was connected with the Consolidation Coal Company at Mt. Savage, Md., for a few years about 1865, but for 40 years past had been with the Reading in various capacities. He served successively as agent at Port Richmond, head of the coal department and finally as vice-president of the Philadelphia & Reading Coal and Iron Company. He organized the present coal transportation and distribution system of the Reading. He was almost the last survivor of the men who served under Franklin B. Gowen, and no one had a more extensive knowledge of the past and present conditions of the anthracite coal industry.

Societies and Technical Schools

Missouri State School of Mines—The fall term of this institution at Rolla will open Sept. 22. This will begin the thirty-seventh year of the school.

Massachusetts Institute of Technology—This institution has established advanced courses in electrical engineering, intended especially for graduate work. Several fellowships for the ensuing year have been granted.

West Virginia Mining Association—This association will meet at Charleston, Oct. 7. At a meeting of the executive committee recently, W. N. Page, of Ansted, president of the association, presided. A committee consisting of William McKell, M. T. Davis and Eli T. Connor was appointed to make the proper arrangements for the October meeting. Another committee which will assign the subjects for discussion consists of William N. Page, Neil Robinson and W. A. Ohley. At the meeting the association expects to have present Captain Desbrough, Herr Meissner and Victor Watteyne, the mining experts from England, Germany and Belgium, who are at present in the United States on the invitation of the Geological Survey. With these three distinguished foreign experts will come Doctor Holmes and Edwin W. Parker, chief statistician of the survey. It is planned by the association that the afternoon and evening of Oct. 7 will be spent in discussion of subjects pertaining to mining, and on the following day the operators will leave on an inspection trip over the Virginian railway. The party will go from Deepwater to Princeton, the present terminus of the road. At the latter point the foreign experts with the representatives of the United States Government will leave the party to make a trip through the Pocahontas field, while the operators will return to Charleston on the same day.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at
San Francisco, Indianapolis, Denver, Butte and London

REVIEWS OF IMPORTANT EVENTS

San Francisco.

Somebody recently started a rumor that the South Yuba Water Company did not intend cutting off the water supply of the mines at Grass Valley and Nevada City, but the superintendent of that company explains the situation briefly as follows: "If the rains are late we will be compelled to conserve the water for domestic purposes and this may mean the shutting off of the water temporarily for power purposes. We are under moral and legal obligations to supply all municipalities that are our customers in preference to the mines and other enterprises using our water for power purposes. So if it becomes absolutely necessary in order to supply the cities using our water we will have to economize by shutting off water used in propelling machinery."

A new mining camp has been established on the desert 14 miles southeast of Cima, San Bernardino county. It is called Gold Valley and a tent city has sprung up there within a few weeks. A number of veins have been located and work commenced on them. The veins are small, but the ore is of high grade. This new camp is located on the east slope of the Providence mountains, 21 miles from Fenner, on the Santa Fe and 18 miles south of Manvel. It is reported that the camp has an abundance of water and wood.

C. R. Downs, of Sutter Creek, Amador county, is bonding coal lands in the Jackson valley, though but little work has yet been done upon them. At one point this coal bed has been prospected to a limited extent on the Fitzsimmons place. Here the coal formation is met with at a depth of 50 ft., and the mineral is found to be of a grade superior to that of the mines around Ione. The vein is 11 ft. thick, and all the coal that has been mined finds a ready sale in the local markets. There is talk of running a railroad to tap the coal lands of this valley; this line would be not more than six or seven miles in length, over a comparatively level country. The coal is of low grade, but adapted for many purposes, and can be mined at small cost.

Judge Ellsworth, of Oakland, has quashed the suit of J. W. Davis, of Sacramento, against the Stillwagon Mining Company, of El Dorado county over mining property in that county worth \$150,000. The decision also gives the Stillwagon company a clear title to a stamp mill and mining machinery valued at \$25,000.

There is more litigation ahead in the suit involving interests in the old Socrates quicksilver mine in northern Sonoma county. Judge Kenny, of Santa Rosa, has granted the motion of C. E. Kinard, an Oakland attorney, representing the claimants of some kind of an interest, to set aside certain defaults. This is his first point gained, after all kinds of demurrers, motions, appearances and arguments. Frank A. Huntington, of San Francisco, is the principal owner of the mine.

San Diego county is now to the front in the matter of discoveries of ores other than those carrying gold. It is announced that a deposit of nickeliferous ore has been found at Boulder Creek by Meyers, Wood, Lockwood & Lynell of that place. The vein is from 3 to 4 ft. wide. A prospector named T. A. Burke, who is working for Alfred B. Lindsay, of San Diego, states that he has found a deposit of tin ore on property 10 miles from Descanso, 14 miles from the Mexican boundary line. No work has yet been done on the claim. Smith Emery & Co., chemical engineers and chemists of San Francisco, have just completed a report on the beds of palagonite paint material, found eight miles inland from Encinitas. The substance is not unlike soapstone, very fine grained and entirely free from any grit. It is considered a fine material for pigment, and 10 or 12 distinct colors, from pale lavender to deep red, are found in the strata forming the bed. Oakland capitalists have undertaken to open the beds and put up a grinding mill.

The operators of the magnesite deposits at Porterville, Tulare county, are enlisting the coöperation of the Chamber of Commerce of the county to bring to the attention of Congress the need of a duty on the substance. These mines at Porterville yield nearly all the magnesite produced in the United States, but their market is confined to the Pacific coast, since it is impossible to compete with the Grecian and Austrian product in the extensive markets east of the Mississippi.

Goldfield, Nevada

Sept. 4—On the 600-ft. level of the Mohawk mine the orebody has been developed for a distance of 175 ft. and has a width of from 20 to 32 ft. that assays from \$40 to \$50 per ton. The big main working shaft at the Claremont mine belonging to the Consolidated company is being sunk with three shifts and is progressing satisfactorily. The steel work

on the new mill is going up rapidly. The first two terraces are about three-quarters completed. Two of the ten 45-ft. Pachuca tanks are erected and the redwood tanks in the cyanide department are being put in.

A double-drum hoist capable of hoisting from a depth of 1000 ft. is being installed at the Florence mine. The shaft is being enlarged to three compartment by raising from the 300-ft. level. This will be the main working shaft, and is being timbered with 10x10-in. sets. This shaft will be sunk to a depth greater than any of the leases and then drifts will be driven to open up at that depth the orebodies developed in the leases. In the meantime the new mill will be started on dump ores.

The Tonopah Mining Company intended when it resumed sinking at the Mizpah shaft in Tonopah to sink this shaft only to a depth of 1300 ft., but new developments have caused the company to decide to sink it to a depth of 1500 ft. and to do the new prospecting work at that level. During the past week the shaft was sunk 18 ft., the bottom now being 1140½ ft. below the collar. There is no change in the formation.

Station sets are being placed every 100 ft. below the 900-ft. level so that the levels may be started at any time. The drill-hole from the bottom of the Red Plume shaft was extended only 29 feet during the week and is now down 267 ft. below the 500-ft. level. The work is rather slow as the rock through which the drill is passing is broken up and sloughs off into the hole causing the string of tools to stick in the hole.

Butte

Sept. 10—On Tuesday there was submitted to the members of the Butte Miners' Union the question as to whether or not the miners should refuse to handle any lumber used in the mines until the differences between the lumber workers and the operators in western Montana should be settled. Had the vote been in favor of the action, it would have been equivalent to declaring a strike among the miners in the Butte district, but, by a vote of nearly four to one the action was voted down. Following the refusal of the miners' union to give support, the lumbermen's union called the strike off the next day and thus averted what might have been serious trouble in the mining industry of the State.

Difficulties with the coal miners of Wyoming and Montana are presenting a problem to the officials of the Amalgamated company in Butte. The latter part of August a conference between the coal miners and the operators of Wyoming was held in Butte for the purpose of considering the wage scale, recently reduced on an average of from 10 to 15c. per day. The conference ended in a disagreement, and on Aug. 31 the coal miners in Wyoming went out on a strike. The Montana coal miners and the operators have been in conference at Helena since Sept. 3, endeavoring to come to some agreement, but as yet no settlement has been effected. The Montana coal mines are still in operation. While much of the coal used in the Butte mines comes from Amalgamated coal properties at Belt, Mont., the greater part comes from the company's mines at Diamondville, Wyoming, which are now closed as a result of the Wyoming strike. As there is now on hand in Butte a supply of coal sufficient to last three months, no apprehension is felt as to the immediate situation.

Denver

Sept. 11—Colorado mining men, who are now holding a two days' meeting in the Chamber of Commerce, at Denver, have introduced some resolutions of great importance to the mining interests of the State. One of these calls upon the legislature to appropriate \$250,000 for a mining temple, which is to be erected here on a scale commensurate with the great importance and vast proportions assumed by that industry in the State of Colorado. Another asks the State to adopt a law for the punishment of fraudulent and untrue statements in the prospectus of mining companies; and another refers to devising means for bringing the mineral advantages of the State to the attention of the mining world in general. Among the subjects discussed were the need of stronger organization and unity among the miners of the State, and the raising by them of a fund for a system of metallurgical experiments and tests to the furtherance of better methods of ore treatment; also the support of a Colorado branch of the Mining Congress. Among other subjects under discussion was the wholesale theft of rich ores, called "high-grading," oppressive taxation on mining properties, the consolidation of operations by long transportation tunnels, and other subjects of vital importance to a State and a great city like Denver, built up by the wealth of the Rocky mountain range. The meeting is still in session.

Indianapolis

Sept. 14—As a direct result of United States Senator Hemenway's mine disaster investigation bill, a commission comprised of representatives of four nations conferred with officials of the Indiana Bi-

tuminous Operators' Association and the District Mine Workers of America, at Terre Haute, Sept. 10. The commissioners were met by a reception committee and shown every attention. The mine investigating committee is composed of the head of the explosives commission of Great Britain, the heads of the Belgian and the German mining commissions, and Dr. J. A. Holmes, of the United States Geological Survey. The Hemenway bill, passed by Congress last winter, provided for an appropriation of \$150,000 to defray the cost of investigating mining conditions in the United States. The bill was prompted by the series of mine explosions and the resulting loss of life.

A special meeting of the miners and operators of the block coalfield was held in Brazil, Sept. 10, and effected an amicable settlement of the differences which threatened to result in trouble. The men filed a complaint that the operators were not moving their coal as fast as they might, according to contract, and doing this in order to keep as many men in the district as possible until the busy season opened. Investigation developed the fact that union miners from other States and districts had been flocking to the block coalfields, all of them in needy condition. These men had been given work until the mines were all so badly crowded that the operators could not move the coal. The questions whether the force of miners should be reduced 25 per cent. in these mines, allowing union miners to be thrown out of employment, or work with them and divide the time, was put squarely to the miners and they decided to let prevailing conditions continue and divide the time.

London

Sept. 5—The Dunderland Iron Ore Company has secured the consent of the debenture-holders to the proposals of the directors for raising additional capital. The company was formed in 1902 to work low-grade iron ores occurring in the northern part of Norway. A dry concentrating plant, consisting of rolls and magnetic separators of T. A. Edison's design, have been erected at the mines, and a railway some 17 miles in length has been built to the seaboard, where the briquetting plant is situated. Altogether about £1,500,000 have been expended in this venture, and further funds are required. The company has had to make many changes in the original plant, especially in connection with the fine rolls and the conveyer belts. Thomas Robins, of the Robins Conveyer Belt Company, of New York, has visited the mines and has proposed certain alterations in the conveyer system which, it is hoped, will prevent the excessive dust and spill troubles previously experienced. Besides technical troubles, the working of the mine has been hampered by labor difficulties. Up to June 30, but 67,101 tons of ore in the form of bri-

quets have been sold at an average price of about \$5.46. When the plant is improved by the reconstruction of the conveyer system, it is hoped to be able to make a profit of £63,750 per annum on an output of 300,000 tons, the estimated costs being \$4.44, and the assumed selling price \$5.46 per ton. The costs include carriage and freight to northeastern ports of England, but exclude general charges and insurance.

Unfortunately for the company, there has this summer been a heavy fall in the price of iron ore, and having regard to this and to the financial straits of the company, the directors have decided to shut down the mines temporarily. In the meantime, if further funds are provided, certain improvements to the plant, which past experience has shown to be necessary, will be undertaken. Whether the mines will pay under the new conditions remains to be seen. The price of iron is, of course, a vital factor; and as stated above, a price of \$5.46 per ton is necessary for an estimated surplus of £64,000. The directors say that the consumption of iron ore has in the past doubled about every 14 years, and they anticipate that as the older sources of supply of iron ore of good quality give out, an appreciation in price is bound to take place. One of the largest stockholders—C. D. Rudd, of South African fame—reminded the shareholders that some of the best mines had had disappointments in their initial stages, and mentioned the case of the Simmer & Jack mine in the Transvaal, now one of the most prosperous of the gold mines of the world, a mine of which he was one of the founders. He said that he well remembered the time when a distinguished mining engineer recommended that the mine should be let out on tribute, as it would not pay if worked by a company. That mines have failed owing to want of pluck, means to push development, or remedy mistakes in design of plant, is no doubt true. It is said that the famous Mysore mine in India was at one time nearly abandoned, and that if it had not been for the courage of some shareholders in providing funds for further development, which shortly after ran into a rich shoot of ore, the mine would have been shut down. Since then, as everyone knows, the mine has had a most prosperous career. It is to be hoped that Mr. Rudd and his associates will succeed in pulling the unfortunate Dunderland mine through. The company has bought its experience dearly, but now that the difficulties connected with the technical treatment of the ore have to a great extent been surmounted, it would seem that only an improvement in the iron market is required to allow these extensive ore deposits, about the occurrence of which there seems to be no question, to be worked at a profit, bringing some return to the shareholders for the large sums that have been invested in the enterprise.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

KATCHIKAN DISTRICT

Victor Copper Mining Company—This company owns a group of claims at Seal Bay, on Gravina island, 12 miles from Katchikan. It has begun work on an adit which is to run the whole width of the group, about 2500 ft., with crosscuts at intervals.

Arizona

GRAHAM COUNTY

Arizona Copper Company—Production for August amounted to 1217 tons of copper. The operation of the furnaces was frequently interrupted in order to make the necessary connection between the furnaces and the new flue. This work was completed before the end of the month.

Arkansas

FRANKLIN COUNTY

The coal miners at Denning, who struck some time ago because the operators refused to employ shot-firers, are still out. About 1000 men are idle.

California

AMADOR COUNTY

Argonaut—Some fine ore has lately been found in this mine at Jackson, and another level is being opened at 2800 ft. depth.

Bellwether—There is a hitch in the negotiations for bonding this property, as, being part of the Bright estate in process of probate, legal technicalities may delay the matter several months.

Jackson Creek—Mushett & Kelly have started work on new gravel ground in the middle fork of this creek.

BUTTE COUNTY

Big Blue Lead Mining Company—This company is taking up its options on mining ground near Bangor and has made its first payment in certain portions, and will soon begin putting in machinery.

EL DORADO COUNTY

Eureka—Unwatering the shaft at this mine has been commenced, and as soon as this is completed extensive development work will be started.

INYO COUNTY

Four Metals Mining Company—The electric power tramway towers of this company up Buena Vista mountain to Cerro Gordo have been erected to within a mile of the furnace at Keeler.

Chicago District—Gunter & Bloomdale,

interested in recent discoveries in this district, have given leases on part of the property. The ore will be milled at the King Brothers plant.

MARIPOSA COUNTY

Mariposa—The building of the mill and other work connected with the opening of this mine is progressing. Part of the machinery is on the ground.

NEVADA COUNTY

A. M. Gilbert, formerly of Chicago and now of Santa Barbara is reopening a number of old quartz properties with a view to making them producers again. In Graniteville district he is opening and developing the Dillon, Boston and Dower mines, some of which have been idle for 30 years. He is also having the Lecompton mine at Nevada City unwatered and has commenced operations on the Oustomah at the same place.

Dolly Madison—After considerable money had been spent in opening this mine it has been given up and the machinery has been removed.

Idaho—At the old workings of this mine, Grass Valley, the water has been removed to the depth of 1000 ft. and re-timbering the shaft has commenced. The old 700 drift has been nearly all cleaned out and a new ore-shoot, never known when the mine was worked by Coleman Brothers, has been found.

Idaho-Maryland Mining Company—At this property, Grass Valley, they have discontinued taking out ore and are engaged in sinking, and driving drifts; 50 men are employed.

Lecompton—At this mine, Nevada City, Samuel Colt, superintendent, two large compressors are being installed and sinking will commence at once.

Norambagua—At this mine, Grass Valley, Samuel Colt, superintendent, a new shaft is to be started from the drain tunnel, which is 500 ft. from the surface.

South Yuba—This company is opening up some old mines in Washington district. It is operating the South Yuba, Eagle Bird and Grey Eagle mines. The new equipment is expected to increase the output, especially as there is now plenty of water power available with the new flumes.

PLACER COUNTY

Lost Emigrant—At this mine, Summit, the shaft is being sunk and preparations are being made to continue work during the winter.

PLUMAS COUNTY

The Western Pacific railway will open up several copper districts where prospecting has been going on for the past few years, but where there has as yet been no production. The Onion Valley mines are being developed as well as those in other districts and in many instances good showing has been made.

SAN BERNARDINO COUNTY

Sunday—This group of seven claims, 12 miles north of Cima, has been sold to Morgan & Parrott, of Pasadena.

SAN DIEGO COUNTY

Escondido Mines Development Company—A 200-ft. shaft has been started on the Asmus lease on this property at Escondido.

SHASTA COUNTY

Graham—This group of copper mines on Pitt river has been bonded by W. E. Casson, who is associated with Eastern men.

Iron Smelting—At Heroult a new 20-ton electric iron smelting furnace is now being put in. It is intended to continue the experiments further in hope of settling on something practicable.

Trinity—By an arrangement made some time ago, the Shasta King mine of the Trinity Copper Company was to deliver to the Balaklala Copper Company of Coram an average of 500 tons daily for the smelter. It is now thought that a greater quantity than this will be delivered from the Shasta King mine. R. N. Bishop has been made joint superintendent of both the Balaklala and Shasta King mines in order to carry out the contract between the companies.

SIERRA COUNTY

Butte Saddle—This group at Sierra City is now under bond to Check & Aldrich who are prosecuting development work.

Cleveland Gold Mining Company—This company at Scales has applied to the California Débris Commission for a license to mine this property by the hydraulic process.

SISKIYOU COUNTY

Highland—The new gasoline power plant has been installed at this mine and the mill is kept running on good ore.

TRINITY COUNTY

Indian Creek—One of the most im-

portant discoveries ever made in this district is that in the Fields quartz property, and development work is being vigorously carried on.

TUOLUMNE COUNTY

Sweeney—After long litigation the ownership of this mine is established in Charles H. Segestrom. Tonopah men will now take the mine and commence the sinking of a 100-ft. shaft. A 20-stamp mill will be erected.

Colorado

HINSDALE COUNTY

Sterling Group—It is reported that a plant of machinery has been bought and will soon be installed on the Sterling group. This group was recently purchased by F. Joubert Pienaar and at present has a fine showing for the amount of development. The mine is on the upper Cottonwood creek near the San Juan county line.

LARIMER COUNTY

Northern Colorado Coal Company—Eastern capitalists have concluded the financing of the Larimer, Hahn's Peak and Pacific railroad, which will open to traffic one of the most remarkable coalfields in the United States. The district is situated near Hebron, Colo. The seam of coal lies 6 ft. beneath the surface and is said to be 40 ft. thick. The coal will be mined by stripping the surface, blasting down the coal and loading with a steam shovel.

OURAY COUNTY

Congress—Development work on this mine near Ouray has opened a promising body of copper ore.

SAN JUAN COUNTY

Ore Shipments—Shipments from Silverton in August were 2000 tons concentrates and 1075 tons crude ore. The larger shippers were the Silver Lake, Hercules, San Antonio and Sunnyside.

Gold King—It is expected that this mine will start up about Sept. 20. The towers of the tramways are now all repaired and work is being pushed on the upper terminal as fast as possible. The tunnel is being cleaned out and re-timbered where it caved near the mouth. Work is advancing on the buildings burned some time ago.

TELLER COUNTY—CRIPPLE CREEK

Lonaconing—Lessees in this mine have opened a body of ore 4 ft. wide, with a small streak of rich sylvanite running through it.

Pharmacist—This company has struck a basalt dike in the mine on Bull hill, at a depth of 900 ft., which promises well. Its extent has not yet been determined.

Wrockloff—Lessees on this claim, on Bull hill, have begun to ship ore. They are preparing to extend development work.

Idaho

SHOSHONE COUNTY

Idora Mining Company—A lease for six months has been given to F. M. Mark, Ed. Lugen and Robert Weedy all of this district. The recent financial troubles of the company have been settled.

Acolian Copper Mining Company—A new water-driven air compressor is about to be installed, and a long flume is in course of construction to connect the mine with Deadman gulch.

Fumerton Property—A foot of rich carbonate ore has been struck in this mine near Osburn. Development work was only commenced recently.

Bunker Hill & Sullivan—This company has just declared its regular dividend for the month of September. This involves the distribution of \$75,000 among the shareholders and makes the total distributed for the year \$630,000, while the grand total disbursed by the present management amounts to \$10,440,000.

Vienna-International—At a meeting of the stockholders and directors held in Wallace the beginning of the week the announcement was made that the mine would resume operations in the near future. A carload of ore is now ready for shipment and there is a large amount of ore ready for stoping as soon as the operations are resumed. It is proposed to expend between \$15,000 and \$20,000 on improvements. A 4000-ft. flume is being constructed to connect with the waters of Placer creek.

Amazon-Dixie—A full face of ore has been opened in the adit. The ore is in the form of clean shipping galena scattered throughout the quartz, the rock being full of ore. The strike was made at a depth of about 200 ft. from the surface and at a distance of about 250 ft. from the portal of the adit.

Advance Mining Company—The annual meeting has just been held in Wallace and officers for the ensuing year elected. It was decided to let a contract for another 100 ft. of work, a contract for a similar amount having just been completed.

Nine Mile Mining Company—A foot of clean shipping galena ore has been encountered in the raise being run on this property to connect the upper and lower tunnels. In addition to this the company has also opened a good body of milling ore.

New Chicago—Small shipments of ore for testing purposes have been made to several different smelters. A large amount of ore is now on the dump, and the company is expecting to begin regular shipments when the Oregon Railroad and Navigation Company's branch road reaches the district, which will be some time this fall.

Snowstorm—It is probable this mine

will resume the payments of dividends with the present month, as it is constantly making shipments to several large smelters, and is operating a large crew. Development work is progressing in the long No. 4 tunnel, but this will not terminate for several months. The mine last year paid dividends amounting to \$45,000 a month.

KOOTENAI COUNTY

Panhandle Smelter—The first furnace will be blown in soon after Oct. 1, and the second will follow shortly. The final work of remodeling is now being done. Coke and fluxing materials are being received, and ore contracts have been let in Montana and Idaho sufficient to keep the plant supplied. It will have a capacity of 250 tons daily.

Green Monarch—A 10-drill compressor will be installed at this property on Lake Pend d'Oreille, and the mine put in shape to work regularly. Its ore will be taken by the Panhandle smelter, to which one carload has already been sent.

Indiana

GREENE COUNTY

Vandalia Coal Mining Company—This company has opened two more mines, Nos. 2 and 3 having resumed operation giving employment to 500 men. Of the nine mines owned by the company seven are working now. The mines just opened have been closed since March. The company is showing greater signs of a prosperous season than any other company in the State.

Louisiana

The total production of petroleum in August from the Louisiana district is reported at 427,600 bbl., a decrease of 28,700 bbl. from July. Shipments for August were 458,098 bbl., or 30,498 bbl. in excess of the production. The number of new wells completed in August was 23, of which 14 were oil producers, one a gas producer and eight dry. There were 38 wells drilling at the close of the month.

Maryland

GARRETT COUNTY

Western Maryland Coal and Coke Company—This company is contemplating the construction of three dams along the Youghiogheny river to develop 15,000 h.p., which will be transmitted as electric power to Pittsburg, 50 miles distant. The company owns 10,000 acres of coal land on each side of the river, and the power generated will also be used in operating the different mines which the company expects to open.

Michigan

COPPER

Superior—The crosscut from the tenth level is in the lode 42 ft., and the hanging

wall has not yet been encountered. The formation at this point is highly mineralized and shows the same quality of rock as in the levels above.

Ojibway—Shaft No. 1 is down about 370 ft. and No. 2 has reached a depth of 425 ft. Sinking will be continued to 500 ft. when a crosscut will be driven to the lode. Barring accidents, No. 2 shaft should reach this point early in October. In the drift from the 350-ft. level of this shaft the formation was leached and broken.

Winona—The lode has been cut at the eighth level of No. 4 shaft and the rock disclosed is richer than any heretofore opened up on this property. Eight machines are in regular service sinking and drifting. The new electrically-operated hoisting plant has been tried out and is working satisfactorily.

King Philip—The crosscut at the ninth level in No. 1 shaft of this tract is in the lode and the formation is well charged with copper. No. 2 shaft is sinking below the 400-ft. level.

Isle Royale—Preparations are being made to sink a new shaft on this property. The outcropping of the Baltic lode was recently discovered on this tract and the shaft will be sunk close to this point. Operations at the south end of the mine are continuing satisfactorily and good ground is being opened up. Nos. 4 and 5 shafts are sinking below the third level and No. 6 is cutting a station for the fourth level. All the rock, accumulated on the stock piles, has been shipped to the mill and all shipments are now going directly from the underground openings.

Atlantic—The lode has again been encountered in the south drift from the twelfth level of this company's Section 16 shaft. This was accomplished after cross-cutting about 25 ft. to the west, at which point the lode was well mineralized; this drift is now within 50 ft. of the Atlantic's boundary line. Drifting to the south from the thirteenth level continues and the formation is settled and well charged with copper; it is evidently a continuation of the good ground that has been opened in the level above. This shaft is sinking about 40 ft. below the seventeenth level and the ground continues fractured.

North Lake—A spur is being laid into this property and the first diamond drill outfit has gone into commission exploring virgin ground.

Michigan—The crosscut from the seventeenth level of "A" shaft has cut the Calico lode and drifting has been started from that point.

Seneca—The new shaft on this tract is down about 60 ft. A new air compressor has been installed and greater progress will be made in sinking from now on; heretofore all drilling was done by hand. Diamond-drill operations are being continued.

Missouri

ZINC-LEAD DISTRICT

Belleville Milling Company—This company has been incorporated by C. W. Munson, J. P. Burns and others, of Joplin.

Elizabeth Mining and Development Company—This company has been incorporated by A. Lowenstein, A. J. Simpson, Joseph Walbrun and W. A. Eyleburg, of Chillicothe, Mo., and E. Tabor, of Joplin.

Center Creek—This company at Webb City has reduced the royalties on all its leases to 20 per cent., on both lead and zinc.

Herald—This company has completed the incline shaft to the bottom of the ore and it is now down to a vertical depth of 308 ft. The company has started producing again.

Grace—This company has taken over the old Cliff lease from the Granby Mining and Smelting Company, and is drilling it thoroughly.

White Dog—This company has taken over the old Majestic mine north of Webb City, and has repaired the mill. It is now pumping preparatory to starting operations.

Lucky Jim—This company has started its new 250-ton mill, and is now producing steadily.

Trimore—This mine, on the Yale land in Leadville hollow, is turning out some of the richest lead seen in the district for some time. The ore is found at 36 ft. in soft ground. Shafts are going down on the Leonard and Granby lands immediately adjoining, to catch the same run.

Lucky May—This company has contracted for a 150-ton mill on its lease on the Heise land near the Morning Hour mine, south of Joplin. The shaft shows 35 ft. of ore, from 107 ft. to 142 ft. depth.

Platta—This company has begun sinking a shaft on its 10-acre lease on the McCown land at Spring City. The drill records show lead and zinc at the same level as the Delta mine.

Moses—This company has made a rich lead strike on its lease at Duenweg at 153 ft. depth, near the lines of the Log Cabin and Layers mines. Both of these are famous lead mines.

Layers—This company is sinking a second shaft on its lease on the Walker land at Duenweg.

Miami—P. W. Hennessey has leased the old Miami mine at Chitwood, north of the Anderson mine, and will work it in conjunction with the Anderson mine.

Leonard Land—The same rich run of lead ore that was struck in the Trimore mine on the Yale land, has been struck in a shaft on the Leonard land at 40 ft. depth.

Montana

BUTTE DISTRICT

Raven—At the annual meeting of stockholders held Tuesday the following were elected directors: John Berkin and Donald Campbell, of Butte; E. C. Frisbee, Robert A. Griffing and E. F. Rea, of Hartford, Conn.; A. B. Curtis and E. A. Slack, of Boston, Mass. The new directors will meet in Boston next week.

North Butte Extension—A. M. Andrews, treasurer, has been in the city several days on business relating to the payment of the company's indebtedness. Mr. Andrews states that he expects, on his return to New York, to complete arrangements for the refinancing of the company.

North Butte Mountain—A contract has been let to James E. Higgins, a mining engineer, of Butte, for the sinking of a 500-ft. shaft.

Pilot-Butte—The company has acquired the O'Rourke interest in the Pilot claim outright, the final payment having been made several days ago. George H. Stanton, counsel for the company, states that arrangements have been made whereby the capital necessary for resumption of operations on the property has been secured, and future payments on the options assured.

JEFFERSON COUNTY

Daly Copper Company—It is stated that negotiations for the raising of \$50,000 for operating purposes are practically completed. A plan to erect an 100-ton concentrator is under consideration.

Blue Bird Mine—A party of Michigan stockholders recently visited the property which is located in the Corbin district. A 5-ft. vein, carrying 5 per cent. copper, is now being worked through a winze sunk in the main tunnel at a point 1100 ft. from the portal of the tunnel. The mine is making daily shipments.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Production—The tonnage from the mine was the heaviest for several months, but the grade of the ore was not as good as usual owing to the large amount of dump rock treated. The ore shipped from the Engineers lease is also not so rich as formerly, for the ore is shipped without being sorted. The total tonnage for the week was 3160 tons valued at \$176,300. The Combination mill treated 630 tons of Consolidated ores. The Nevada Goldfield Reduction Company treated from: Combination Fraction, 140 tons; Mushett lease, 130; Sandstorm, 120; dump ores, 810 tons. The Western Ore Purchasing Company handled from: Mohawk Jumbo, 700 tons; Engineers lease, 200; Consolidated Red Top, 220; Florence Consolidated 40 tons of mine and 70 tons of dump ore.

Combination Fraction—The Little

Florence lease on this property is in shipping ore on the 100-, 200- and 500-ft. levels. The old shaft has been enlarged to three compartments. The vein is from 3 to 7 ft. wide.

Laguna—L. L. Mushett has bought out his Kansas City partners in the Mushett lease on this property and has resumed work at this lease which has been shut down for a short time. Prospecting on the 480-ft. level will be pushed to cut a vein known to exist in the direction of the work. The last shipment of 300 tons was not especially rich, but made a creditable return. The lease has already netted more than \$75,000.

Mohawk Ledge—Work on this lease is now confined to sinking. There is considerable ore in the upper levels near the east and west sidelines, but as the lease resumed work under the new vertical side and endline agreement it cannot follow this ore beyond the boundaries of its lease. Little development will be done until the shaft has been sunk to a depth of 700 feet.

Yellow Tiger—Work on the leasehold of the Elk Consolidated has been temporarily suspended for reasons unexplained. Two weeks ago a rich strike on the 600-ft level was reported and no visitors were allowed to enter the mine. The 600-ft. level which is producing a lot of water will be bulkheaded and the shaft will be sunk 200 ft. deeper before drifting on the big dike will be resumed.

Consolidated Red Top Mining and Leasing—This lease on the north end of the Red Top claim is producing 30 tons of ore per day from the 225-ft. level. The bottom of the winze which is down 35 ft. is also shipping ore. The last shipment from the lease assayed \$64 gold and \$3 silver per ton. On the 150-ft. level this same oreshoot has just been cut; the ore is as rich as that below. On the 300-ft. level the crosscut is in good looking quartz. A 50-h.p. electric hoist will be installed.

Atlanta—Milwaukee men have taken a lease on the Union Jack claim of the Atlanta group. The shaft which is 280 ft. will be sunk to a depth of 700 ft. before doing any lateral work. The lease has 2½ years to run.

ESMERALDA COUNTY—RAWHIDE

A fire on Sept. 4 completely destroyed eight blocks in the business portion of Rawhide, causing a loss of between \$500,000 and \$750,000. Two lives were lost. All the hotels, restaurants and supply houses were burned. A relief train was run from Goldfield and Tonopah, consisting of two refrigerator cars, filled with food, and several flat cars loaded with automobiles, which were used to rush the provisions from Mina to Rawhide. Very little mining property was injured. As soon as the ashes were cool rebuilding was begun.

NYE COUNTY—TONOPAH

The production for the week amounted to 6040 tons of ore, worth \$160,800, distributed as follows: Tonopah Mining Company, 3450 tons; Belmont, 750; Montana-Tonopah, 1000; Midway, 100; MacNamara, 250; West End, 165; Jim Butler, 200; Tonopah Extension, 130 tons.

Tonopah Mining Company—The main three-compartment shaft is now 1180 ft. deep. Little progress was made with the drill hole in the Red Plume shaft. The bottom of the hole is now 267 ft. below the 500-ft. level. In the extreme westerly workings on the third or 340-ft. level of the Silver Top mine the new developments are very encouraging; the face of the drift now shows 4 ft. of good milling ore. A new orebody is being opened up on the 300-ft. level of the Mizpah. Recently in cutting out stopes from the west drift along the Mizpah fault a body of milling ore was found, which has been opened up for over 50 ft. This ore is 5 ft. wide. The vein is strong and well defined, and indications point to its developing into a big body. Some development work is also being done in the 500- and 800-ft. levels.

Montana-Tonopah—On the 390-ft. level the west drift on the south vein, which is now 121 ft. long, shows good milling ore in the roof, but the orebody has been faulted at this point. A winze on this vein 60 ft. from the face is 10 ft. deep, and shows 2 ft. of low-grade milling ore. A raise on this vein at another point shows 3 ft. of the same ore.

Belmont—The orebody at this mine seems to be the largest in the camp. The winze on this big vein from the 1000-ft. level is now down 87 ft. and is still all in ore, although the winze is 7 ft. wide by 20 ft. long. This orebody has been proved to be over 20 ft. wide for more than 200 ft. along the drift and for nearly 200 ft. above the 1000-ft. level.

Tonopah Extension—Only prospecting is being done on the 400- and the 770-ft. levels. The faces of both the north and the south crosscuts from the west drift on the 400-ft. level, 1000 ft. west of the shaft, are now in a promising porphyry, carrying occasional quartz stringers.

West End—The raise from the 400-ft. level, 17 ft. west of the shaft, has connected with the stope started 35 ft. above the bottom of the shaft; this raise is in good ore. The stope extends upward from this connection 16 ft., so this orebody is over 50 ft. high, with no indications of either the top or bottom in sight. Stopping continues on the vein developed on the 150-ft. level near the MacNamara line; the ore is 7 ft. wide.

MacNamara—Work is still confined to a portion of the workings on the 200-, 275- and 300-ft. levels, as the new drills have not been started as yet. Shipments

during the past week were smaller than usual, as the boilers and engine were being overhauled; three cars of ore were sent to the smelter, and two cars to the mills, a total of 250 tons.

Jim Butler—Work is still confined to the levels worked from the Stone Cabin shaft. The Stone Cabin shaft was sunk 12 ft. during the week, and is now 640 ft. deep.

Oklahoma

Petroleum production in August is reported at 3,729,651 bbl. Shipments and deliveries were 3,330,609 bbl.; estimated stock at the end of the month, 52,509,931 bbl. There were 287 new wells completed during the month, of which 262 were oil producers, four gas producers and 21 dry. There were 190 new wells drilling on Aug. 31. The average production of the new wells was 99 bbl. per day.

Pennsylvania

ANTHRACITE COAL

Warrior Run—Violation of the mine laws in three particulars were pointed out at the coroner's investigation of the slope disaster which occurred Aug. 28. The alleged violations of the mine laws were: (1), not having safety blocks at the head of the slope; (2), failure to place a headman at the top of the slope from the time men descend into the mine until all are out; (3), in hoisting more than 10 men at a time without being so requested by at least 30 of the employees of the colliery and receiving written permission from the mine inspector of the district.

BITUMINOUS COAL

Monongahela River Consolidated—This company reports for the nine months of its fiscal year from Nov. 1 to July 31, earnings above operating expenses, \$1,692,345, a decrease of \$58,869. Taxes, interest, depreciation and sinking fund on coal mined amounted to \$1,091,569, leaving a surplus of \$600,776, a decrease of \$78,358 from last year.

COKE

Fort Palmer Coal and Coke Company—The contractors have completed work on the plant of by-product coke ovens near Ligonier. There are 180 longitudinal ovens in two batteries.

McClelland-Echard Coke Company—This company, which owns the Blosser tract of coking coal near Marion, has now 24 ovens completed and 46 more under construction. The name of the company is to be changed to the Fayette-Connellsville Coke Company.

Philippine Islands

BATAN ISLAND

The government coal mine on Batan is being opened, and it is expected that shipments of 2500 tons a month can be made, beginning with October.

BENGUET

Gold production in June is reported by the following companies: Benguet Consolidated, 109 oz. gold and 70 lb. cyanide bullion; Bua, 133 oz. gold and 25 lb. cyanide bullion; Paracale Dredge, 463 oz. gold.

Headwaters Mining Company—This company has been organized to open and operate a gold mine at Antamok, in Benguet. It has bought 12 claims, on which prospecting has shown several promising veins. F. H. Higham, of Manila, is secretary.

CEBU

Insular Coal Company—This company is pushing work on its coal mine at Camansi. It has obtained a franchise to build a railroad 12 km. long, from its mines to the port of Danao.

South Dakota

CUSTER COUNTY

Ruberta—The new 30-ton cyanide plant will shortly be in operation, and it will treat ore in connection with the 10-stamp mill. It will be in charge of C. A. Overmire.

LAWRENCE COUNTY

Golden Placer Company—At the annual meeting the following officers were chosen: F. A. Curtiss, Deadwood, president; A. S. Curtiss, Newark, N. J., vice-president; G. L. Reichhelm, Jersey City, N. J., secretary. The mine will be further developed and the capacity of the treatment plant raised to 75 tons per day.

Globe—President Morse is here to make arrangements for resuming work in the mill and mine. Some slight changes will be required in the 200-ton electrochemical plant, but the mine is already well developed.

Homestake South Extension—Ore has been encountered on the 200-ft. level in a drift. The lode proves to be an orebody of some consequence and is being developed.

PENNINGTON COUNTY

Balkan—Construction of the five-stamp plant near Rochford has commenced. It is hoped to have it in operation within a few weeks. The property is owned by some Chicago men.

Burlington—New directors have been chosen: Joseph Sharpe, of Hill City, and F. W. Wiltse, of Des Moines, Iowa, succeeded the late J. B. Taylor and C. Miller. Raymond Taylor will have charge of the property. The 170-ft. shaft will be sunk deeper.

Rochford Mining Company—The Standby mill is now running and treating about 75 tons of ore per day. This is the first run of the mill in several years. It has been thoroughly renovated and re-modeled.

Wyoming

As a result of a general strike of all of the coal miners in the State, all the mines were closed down Sept. 1. So far there has been no disorder in any of the camps, and it is believed that the operators and the miners will soon reach a friendly settlement.

Canada

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore for the week ending Sept. 5 were as follows: Coniagas, 64,700 lb.; Chambers-Ferland, 61,650; Drummond, 302,490; Kerr Lake, 82,200; La Rose, 255,700; Nipissing, 187,910; Nova Scotia, 40,500; O'Brien, 189,000; Trethewey, 120,310; total, 1,304,460 pounds.

Crown Reserve—A vein 4 in. wide rich in native silver has been struck in a cross-cut 50 ft. from the main shaft. It is 20 ft. farther in the crosscut than the main vein to which it runs parallel.

Nipissing—Rich ore was encountered recently in No. 25 vein, which, at 60 ft. in depth, is 5 in. wide and is heavily shot with silver.

Right of Way—A vein 2 in. wide has been encountered 9 ft. from the shaft, from which slabs of silver have been taken. At 14 ft. another narrow vein was struck which showed native silver.

Trout Lake Smeltery—This smeltery, near North Bay, constructed at a cost of \$500,000, for the treatment of Cobalt ore has been acquired by a Detroit syndicate and is now ready for operation.

ONTARIO—LARDER LAKE DISTRICT

Tourenic Mining Company—The report presented at the annual meeting held Sept. 3 showed that \$6000 had been expended on development work. Two shafts are being sunk, one of which is down 60 ft. Assays at various levels show \$8 to \$22 in gold per ton.

ONTARIO—STURGEON LAKE DISTRICT

Frost Location—J. W. Frost, who represents a syndicate of British Columbia capitalists having iron claims north of Sturgeon lake, reports that \$5000 has been expended on development work, uncovering specular hematite extending for five miles; the deposit has a depth of 25 ft. It is within 15 miles of the route of the Grand Trunk Pacific and on the completion of the road a spur will be built to the mine.

Mexico

CHIHUAHUA

Parral Output—The production of the Parral camp for the week ending Aug. 29 was approximately 8500 tons, of which about 3500 tons were shipped to outside reduction plants.

Southern Mining Company—This company lately suspended mining and milling

operations at its Santa Marguerita properties in the Ocampo district. It is announced that work will be resumed not later than Jan. 1 under new management. The president of the company, W. C. Barnett, of Birmingham, Ala., was a visitor at the property during August.

Veta Colorada—A reorganization of the affairs of this company, which owns the Quebradillas and other mines in the Parral section, is under way, and it is announced that operations will be resumed shortly.

Bravos District—Among the present active properties in this lead-silver section in the northern part of the state, reached from Moctezuma on the Mexican Central, are the following: El Rosario, Buena Vista, Quo Vadis, Detroit, Houston, Independence and Fortuna. The first two are under the management of D. C. Sutton.

Florencia—This Santa Eulalia property, operated by S. G. Burn and R. J. de Morambert, was lately sold for a large consideration to E. M. Campbell and Indianapolis associates. Transfer has already been made and J. C. Shepherd is the superintendent in charge for the new owners. The property was held by the sellers under a working bond from Governor Creel.

GUANAJUATO

Production—Shipments of bullion from the various properties during the week ending Sept. 7 amounted to \$180,000. The value of the concentrates was \$100,000.

Peregrina—This company, controlled by the Securities Corporation, Ltd., on Sept. 1 paid its regular semi-annual dividend of 3½ per cent. to its preferred stockholders.

OAXACA

Oaxaca Smelter—It is reported that the company has organized its force of employees, has signed a favorable contract for the low-grade ores of the Teziutlan property near Ocotlan and will soon begin operations.

Escuadra and Conejo Blanco—The properties have been examined by engineers in the interest of the El Oro Mining and Railroad Company.

Natividad—The company is increasing the capacity of the mill at Sierra Juarez to 150 tons per day by the addition of tube mills. A cyanide annex with Pachuca tanks and filters is being installed.

San Jose De Gracia—The Mexican Mines Prospects Development Company, which owns this property at Sierra Juarez, has started the 10-stamp mill and will install Pachuca tanks and Moore filters this fall.

Benito Juarez—An option on this property, consisting of 250 pertenencias lying between the Natividad and the Manchega, has been taken by the Mexican Mines Prospects Development Company.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Sept. 16—The coal trade in the West shows some further signs of improvement, but the advance is still slow. Steam coal is selling better at some points, but consumers seem to be very slow about putting in winter stocks.

Through all the western districts of Pennsylvania the mines have had much trouble on account of scarcity of water, resulting from the dry summer. At some mines it has been necessary to haul water in cars to supply the boilers, and almost everywhere there has been more or less trouble.

This scarcity of water extends to the anthracite region, and has interfered with operations of mines and washeries. The anthracite trade generally is quiet. Consumers seem slow to put in stocks, and there has been no cool weather yet to stir them up.

Bituminous coal trade in the East is dull, with light demand for steam coal. The call for the Coastwise trade is less than for several years at this season.

COAL TRAFFIC NOTES

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Sept. 5, in short tons:

	1907.	1908.	Changes.
Anthracite.....	3,843,354	3,435,533	D. 407,821
Bituminous.....	26,249,864	22,093,146	D. 4,226,718
Coke.....	9,595,475	4,613,678	D. 4,981,797
Total.....	39,728,693	30,112,357	D. 9,616,336

Total decrease this year to date was 24.2 per cent.

The weekly reports compiled by the Connellsville *Courier* show that the production of coke in the Connellsville regions for the eight months ended Aug. 31 was, approximately, 14,040,800 tons in 1907, and 5,931,300 tons in 1908; a decrease of 8,109,500 tons, or 57.8 per cent.

Coal passing through Sault Ste. Marie canals, season to Sept. 1, short tons:

	1907.	1908.	Changes.
Anthracite.....	877,154	901,335	I. 24,181
Bituminous.....	6,328,953	4,955,541	D. 1,333,412
Total.....	7,206,107	5,896,876	D. 1,309,231

The August report shows a total of 2,027,425 tons, or 80,149 tons less than July.

New York ANTHRACITE

Sept. 16—The anthracite trade shows a slight improvement in a few places, but not enough to affect the trade in general. The Lake business is light, and most of

the consumers seem to have sufficient stocks to meet their requirements.

Schedule prices are \$4.75 for broken, and \$5 for egg, stove and chestnut. Steam-size prices are unchanged: Pea, \$3.25@3.50; buckwheat, \$2.35@2.50; buckwheat No. 2, or rice, \$1.60@2; barley, \$1.35@1.50. All prices are f.o.b. New York harbor points.

BITUMINOUS

The situation in the soft-coal trade is discouraging, and practically no new business is being done at any of the consuming points along the Atlantic seaboard. Shoal-water ports seem to be indifferent regarding their winter stocks, which are usually being taken on at this time. It is doubtful if the consumers in the far East have sufficient stocks, and producers are at a loss to understand why orders are not forthcoming.

New York harbor trade is very dull and ordinary grades of coal are selling at \$2.40@2.45, with better grades offered at \$2.50@2.60. All-rail trade lacks interest. Cars are in good supply, and transportation from mines to tide is up to requirements.

In the Coastwise trade small vessels seem to be scarce in New York harbor, probably because they are bunched in the East. Rates for large vessels from Philadelphia are: Boston, Salem and Portland, 50@55c.; Lynn, 60@65c.; Portsmouth and Bath, 60c.; Newburyport, Gardiner and Bangor, 65@70c.; Saco, 90c.@ \$1; Providence, New Bedford and the Sound, 45@50c. per ton.

Birmingham

Sept. 14—The coal miners of Alabama who were on strike for two months, are returning slowly to work again and the production in this State is improving. It will be several weeks before the output will be up to the figures desired. At some mines it was necessary to pump out water and make necessary repairs before operations could be begun. The coke ovens are being started up on all sides. The importation of coal and coke has been stopped.

Chicago

Sept. 15—The coal market continues firm, but does not strengthen noticeably. It is still too warm for domestic trade to increase and steam trade awaits a general revival of business. In Western coals the most important feature is the weakening of fine coals and the strengthening of

lump and egg. Anthracite has a slight movement in city trade and scarcely any in the country.

Fairly good sales are made of lump and egg from Illinois and Indiana mines at \$1.75@2.45; run-of-mine brings \$1.55@1.75 and screenings, \$1.25@1.45, for carlots.

Eastern coals are uneven, smokeless being plentiful as to run-of-mine and scarce as to lump, the former bringing \$3.30@3.45 and the latter \$4.05@4.30. Hocking is fairly firm at \$3.15, and Youghiogheny moves mostly on contracts at \$2.90@3.10 for 3/4-in. lump. List prices on smokeless and Hocking are cut less than a few weeks ago.

Indianapolis

Sept. 15—The coal-mining industry in Indiana continues to show life and increasing activity. That the production of the mines is steadily increasing is proved by the loaded cars that fill the switches and side tracks of the coal-carrying railroads. The sale of coal is not up to expectation, but the billing out of loaded cars reflects the gradual recovery of the industry. The demand for coal from the Northwest is slow and the natural tendency this year in that section is to hold back as long as possible. The Indiana mines are in excellent condition. Labor troubles are about all settled; the differences remaining are chiefly among the officials of the local and national unions.

Pittsburg

Sept. 15—The railroad mines in the Pittsburg district are being operated this week at about 85 per cent. of capacity. A few river mines are running, but all must close in a few days unless more empty barges are received from lower ports. The drought is interfering to a certain extent in the operation of the coal mines. Prices remain \$1.15 at mine, but some small producers are said to be shading by about 10c. Slack shows an improvement and the lowest price is 50c. this week.

Connellsville Coke—Production has fallen off, owing to the enforced closing of a number of ovens due to the drought. Prices for prompt shipment show some improvement. Furnace coke is \$1.65@1.85 and foundry \$2.10@2.25, both prompt and on contract. The *Courier* gives the production in both fields at 192,212 tons. The shipments were 7638 cars, as follows: To Pittsburg, 2983; west of Pittsburg, 4273; east of Connellsville, 382 cars.

Iron Trade Review

New York, Sept. 16—The general conditions of the iron and steel trade do not show much change. A conference of officers of the United States Steel Corporation was held in New York this week. It was private, but President Corey announced that the reports made showed a gradual improvement.

Pig-iron sales have been fair, but the attempt to put up prices seems to have been abandoned. Southern iron is fairly well sold up for fourth quarter deliveries, and makers are asking \$13 and \$13.50 Birmingham for No. 2 foundry.

In finished material some contracts for cars are reported. Railroad business, as a rule, does not come forward freely. Few orders for standard rails are reported. For light-rail orders there is a good deal of competition, and some have been placed at \$25, or \$3 below the price of standard sections. The difference is usually the other way.

There are reports of lower prices for structural material. Contracts are being held back, probably on account of some expectation of this kind.

Pig Iron Production—The reports from the blast furnaces show that on Sept. 1 there were 179 coke and anthracite furnaces in blast, having a total weekly capacity of 313,100 tons; an increase of 28,500 tons over Aug. 1. This is the largest weekly capacity reported since Dec. 1, 1907, but is 194,700 tons less than on Sept. 1, 1907. Taking the official report for the first half of the year, the *Iron Age* estimate for July and August, and making allowance for the charcoal furnaces, the production of pig iron in the United States was, approximately for August, 1,363,000 tons; for the eight months ended Aug. 31 it was 9,516,000 tons.

Birmingham

Sept. 14—Alabama pig-iron manufacturers are in a better mood as the iron market continues to improve, the inquiry for iron for next year's delivery becomes more pronounced and the quotations stronger. There are some small-lot sales for immediate delivery while a steady buying for delivery toward the latter part of the year is noted. Practically all the manufacturers in this territory are asking \$13 per ton, for No. 2 foundry, as the present price and car-lot sales have been made recently at \$13.50. Some sales have been made for delivery during the first quarter of 1909 at \$14 per ton, No. 2 foundry. The Sloss-Sheffield company has one furnace under repair and the Tennessee company has three at Ensley and Bessemer nearing completion and one in Oxmoor. There is not much iron in the yards in this district. The Republic company is making iron at No. 3 furnace at Thomas, but No. 1 will have to be blown out for repairs.

Chicago

Sept. 15—General conditions in the iron business are improving. The sale of pig iron is variable from day to day, but the general average is greater than in previous weeks. Northern local furnaces hold well to \$17 and in some cases get 25@50c. more, while a few sales are made 25@50c. less. Southern iron holds well to \$13 Birmingham (\$17.35 Chicago) as a minimum, but shades this figure occasionally to compete with Valley iron, which has sold at \$16.50. The average lot sold is still small, but the demand for such lots is steady. Contracts are being made to an increasing extent.

Sales of iron and steel are better; railroad supplies, structural steel and bars all show progress. Coke is firm with sales reported better, at \$4.90 for first-class Connellsville.

Cleveland

Sept. 14—Shipments of iron ore from the Lake Superior region for the season to Sept. 1 were as follows, by ports, in long tons:

	1907.	1908.	Changes.
Escanaba.....	3,731,165	1,351,513 D.	2,379,652
Marquette.....	1,924,464	625,399 D.	1,299,065
Ashland.....	2,314,760	1,037,185 D.	1,277,575
Superior.....	4,416,454	1,723,208 D.	2,693,246
Duluth.....	7,202,645	4,583,987 D.	2,618,658
Two Harbors.....	4,752,064	2,663,644 D.	2,088,420
Total.....	24,341,552	11,984,936 D.	12,356,616

The August shipments were the largest reported this season—4,749,655 tons.

Philadelphia

Sept. 16—The situation continues to improve. Between new orders and the ordering of delivery of iron on old contracts, there is a steady depletion of stocks. Southern irons have ceased to be a disturbing factor. New England and eastern Pennsylvania buyers are taking larger lots for this year's delivery. Orders for next year are few, partly because of a difference of views on prices. Buyers generally do not take seriously the talk concerning advancing prices in the face of so much idle capacity. Delivery quotations are \$16.50@17 for No. 2; \$16 as an average for No. 2 plain; basic, as low as \$15.50.

Steel Billets—Some small orders were placed this week.

Bars—Retail distribution is somewhat better at local stores, but large mill orders are exceptional.

Sheets—All mills in Pennsylvania are getting more business, but not enough to impart visible vitality.

Merchant Steel—More business is being done along several lines of merchant steel, but purchases are strictly from hand to mouth.

Plates—Rather low prices were named this week on a few inquiries for early delivery. Boiler plate is about the only kind that is selling.

Structural Material—Some very sharp

bidding has been done this week on new business presented which goes to show that after all shapes have not reached bottom prices. Inquiries are in the market for about 40,000 tons in all for early winter delivery. Local plants are now on full time again.

Scrap—Heavy melting scrap is in active demand and is bringing a fair price. Railroad scrap is dull.

Pittsburg

Sept. 10—While conditions in the iron and steel trade continue dull there is increasing evidence of an improvement in the near future. During the past few days jobbers in the various finished lines have been making inquiries as to prices and terms, with a view to replenishing their stocks; their warehouses are now practically bare. Another basis for a brighter outlook for next month is the assurance that the railroads will come into the market for their requirements for the rest of the year and also for 1909.

A meeting of the general committee of iron and steel men named by Chairman E. H. Gary, of the Steel Corporation last fall, it is reported here, is to be held in New York during the coming week, when the situation will be reviewed and the question of prices discussed. It is hinted that a temporary reduction in prices will be decided upon to bring the jobbers and other large buyers into the market. According to estimates made here this week mill operations are around 60 per cent. of capacity.

Pig Iron—The iron market does not show any material improvement, but stocks are lower than at any time this year. There are no stocks of foundry iron and at the opening of the week less than 60,000 tons of bessemer and basic iron are in stock at Valley furnaces. The bessemer average for August was \$15.21, Valley, compared with \$15.93 in July. This indicates that \$15 at furnace can easily be done on prompt shipments. Malleable bessemer shows an improvement and is quoted this week at \$14.75. Basic is down to \$14.50. A number of sales of No. 2 foundry have been made during the past few days in lots of carloads to 200 tons, some at \$14.50 up to \$15. Gray forge is nominal at \$13.50. These quotations are at Valley furnaces. The Massillon Iron and Steel Company is in the market for 4500 tons of Nos. 2, 3 and 4 foundry, October delivery.

Steel—Billets remain firm at \$25, Pittsburg. Plates are strong at 1.60c. and merchant-steel bars at 1.40c.

Sheets—Some fairly large transactions are recorded this week. More mills are in operation. Black sheets continue at 2.50c. and galvanized at 3.55c. for No. 28 gage.

Ferro-Manganese—Minimum price for prompt shipment, \$45, Pittsburg; for future delivery \$46 is quoted.

Metal Market

Gold and Silver Exports and Imports
NEW YORK, Sept. 16.
At all U. S. Ports in July and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
July 1908..	\$ 4,845,272	\$ 2,916,408	Exp. \$ 1,928,864
" 1907..	7,478,366	3,410,782	" 4,067,584
Year 1908..	58,363,247	29,324,304	" 29,038,943
" 1907..	43,779,098	24,879,429	" 18,899,669
Silver:			
July 1908..	4,930,746	2,982,074	Exp. 1,948,672
" 1907..	5,955,042	3,387,225	" 2,567,817
Year 1908..	30,445,291	24,123,422	" 6,321,869
" 1907..	35,174,251	25,782,836	" 9,391,415

Exports of specie from New York week ended Sept. 12: Gold, none; silver, \$731,724, to London. Imports: Gold, \$115,391; silver, \$58,009, from South America and Mexico.

Specie holdings of the leading banks of the world, Sept. 12, are reported as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York			\$326,511,600
England.....	\$190,766,840		190,766,840
France.....	644,041,435	\$180,114,575	824,156,010
Germany.....	194,230,000	79,790,000	274,020,000
Spain.....	78,540,000	171,145,000	249,685,000
Netherlands.....	38,530,000	20,300,500	58,830,500
Belgium.....	20,633,335	10,316,665	30,950,000
Italy.....	185,590,000	22,500,000	208,090,000
Russia.....	581,895,000	39,535,000	621,430,000
Aust.-Hungary.	239,205,000	65,745,000	304,950,000
Sweden.....	20,405,000		20,405,000
Norway.....	8,655,000		8,655,000
Switzerland....	22,780,000		22,780,000

The New York banks do not separate gold and silver. The foreign statements are from the *Commercial and Financial Chronicle* of New York.

Gold and silver movement in France, seven months ended July 31:

	Imports.	Exports.	Excess.
Gold....	Fr. 581,787,000	Fr. 16,193,000	Imp. Fr. 565,594,000
1907....	284,205,000	80,157,000	Imp. 204,048,000
Silver....	90,761,000	103,978,000	Exp. 13,217,000
1907....	99,996,000	102,503,000	Exp. 2,507,000

Imports of nickel and copper coins, 55,000 fr. in 1907, and 35,000 fr. in 1908; exports, 211,000 fr. in 1907, and 560,000 fr. this year.

Silver Market

SILVER AND STERLING EXCHANGE.

Sept.	Sterling Exchange.	Silver.		Sept.	Sterling Exchange.	Silver.	
		New York, Cents.	London, Pence.			New York, Cents.	London, Pence.
10	4.8645	51 1/2	23 1/8	14	4.8650	51 1/2	23 1/8
11	4.8660	51 1/2	23 1/8	15	4.8655	52 1/2	24 1/8
12	4.8660	51 1/2	23 1/8	16	4.8675	52 1/2	24 1/8

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to Sept. 3:

	1907.	1908.	Changes.
India.....	£8,111,834	£6,448,433	D. £1,663,401
China.....		516,400	I. 516,400
Straits.....	598,700	90,510	D. 508,190
Total.....	£8,710,534	£7,065,343	D. £1,645,191

Receipts for the week £166,000 from New York. Exports £1100 to Egypt and £141,700 to India; £142,800 in all.

Indian bazaar buying has carried the price of silver up to 24 1/16d. in London. If a good demand for spot silver should set in a sharp advance might take place, owing to the heavy short future interest, the market being heavily sold forward; but what will actually result is problematical.

Copper, Tin, Lead and Zinc

DAILY PRICES OF METALS.

Sept.	Copper.			Tin.	Lead.	Spelter.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.			New York, Cts. per lb.	St. Louis, Cts. per lb.
10	13 1/2 @13 1/2	13 1/2 @13 1/2	60 1/2	28 1/2 @4.52	4.77	4.62	4.67
11	13 1/2 @13 1/2	13 1/2 @13 1/2	60 1/2	28 1/2 @4.52	4.77	4.62	4.67
12	13 1/2 @13 1/2	13 1/2 @13 1/2	60 1/2	28 1/2 @4.55	4.77	4.62	4.67
14	13 1/2 @13 1/2	13 1/2 @13 1/2	60 1/2	28 1/2 @4.55	4.77	4.62	4.67
15	13 1/2 @13 1/2	13 1/2 @13 1/2	61	28 1/2 @4.52	4.77	4.62	4.67
16	13 1/2 @13 1/2	13 1/2 @13 1/2	60 1/2	28 1/2 @4.52	4.77	4.62	4.67

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b.s. The New York quotations for electrolytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—Consumers appear to have satisfied their requirements for some time to come, wherefore the market has been dull and nominal since Sept. 9, but with a softer tone. Nothing but small business has been done. First hands, who sold freely during the recent past, are not ostensibly pressing copper for sale. Some of them are indeed holding aloof, but others appear to be willing to make concessions without openly breaking the market. Owing to the absence of any demand of consequence, it is difficult to gage the attitude of these sellers. Second-hand lots have been freely offered at concessions. The market closes easy at 13 1/2 @ 13 3/4c. for Lake copper; 13 3/8 @ 13 1/2c. for electrolytic in ingots, cakes and wirebars. The average price at which business in casting copper has been done during the week is 13 1/8 @ 13 3/4c.

The increase in the statistics of 3250 tons has been foreshadowed in the London standard market for some days, and the close is lower at £60 7s. 6d. for spot, £61 2s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £63 @ 64; best selected, £63 @ 64; strong sheets, £75 @ 76.

German consumption of foreign copper, seven months ended July 31, reported by L. Vogelstein & Co.: Imports, 94,501 tons; exports, 4754; apparent consumption, 89,747 tons, an increase of 20,984 tons. Of the imports given 87,373 tons were from the United States.

Exports of copper from New York and Philadelphia for the week were 2113 long tons. Exports from Baltimore, as reported by our special correspondent, were 496 tons.

Manufactured Copper—Sheets, cold-rolled, 19c. per lb.; hot-rolled, 18c. Copper wire, 15 1/4c. base, carload lots at mill.

Tin—The local market followed with great hesitation the improvement shown in London early in the week, and as a matter of fact prices ruling here were right along below parity. It is not surprising, therefore, that owing to lack of support from here, London prices should show a weaker tendency at the close, the quotations being £130 15s. for spot, £132 for three months, while business is being done here at around 28 3/4 cents.

Lead—Fair-sized quantities of lead are being offered from St. Louis and by local speculators, and as there is no active demand, sales have been effected at steadily declining prices. The close is weak at 4.47 1/2 @ 4.52 1/2c. New York.

The market in London has steadied and is holding its own fairly well, closing at £13 2s. 6d. for Spanish lead, £13 5s. for English lead.

Spelter—Business in this metal has been of fair proportions. Prices have not only held, but have advanced somewhat further, the close being steady at 4.62 1/2 @ 4.67 1/2c. St. Louis, 4.77 1/2 @ 4.82 1/2c. New York.

Abroad the market has also shown a tendency to advance, and the close is quoted £19 10s. per ton for good ordinaries, £19 15s. for specials.

Zinc Sheets—Base price is 7c. f.o.b. La Salle-Peru, Ill., less 8 per cent.

Other Metals

Antimony—The market, both in New York and abroad, is dull and uninteresting. Quotations are 8 1/8 @ 8 3/8c. for Cookson's; 7 7/8 @ 8c. for Hallett's; 7 5/8 @ 7 7/8c. for ordinary brands.

Aluminum—Ingots, American No. 1, in large quantities, 33c. per lb. Rods and wire, 38c. base; sheets, 40c. base.

Cadmium—In 100-lb. lots, \$1.25 per lb., at Cleveland, Ohio.

Nickel—According to size of lot and terms of sale, 45 @ 50c., New York.

Quicksilver—New York price is \$43 per flask for large lots; small orders depend on size and conditions. San Francisco nominal, about \$42.50 for domestic orders, and \$41 for export. London price is £8 2s. 6d. per flask, with £8 quoted from second hands.

Platinum—Quotations by the principal dealers are: \$22.50 for hard platinum, \$20 for ordinary and \$16 for scrap. How-

ever, offers of the metal continue to be made at \$17.50@19 per ounce.

Imports and Exports of Metals

Exports and imports of metals in the United States for the seven months ended July 31 are reported as follows, in the measures usual in the trade:

	Exports.	Imports.	Excess.
Copper, long tons	191,868	43,370	Exp. 148,498
Copper, 1907....	98,350	76,645	Exp. 21,705
Tin, long tons....	138	20,359	Imp. 20,221
Tin, 1907.....	333	25,075	Imp. 24,742
Lead, short tons.	41,636	61,591	Imp. 19,955
Lead, 1907.....	26,061	42,861	Imp. 16,800
Spelter, sh. tons.	1,991	261	Exp. 1,730
Spelter, 1907....	383	522	Imp. 139
Antimony, lb.	4,648,253	Imp. 4,648,253	
Antimony, 1907.	5,141,911	Imp. 5,141,911	
Platinum, oz.	18,276	Imp. 18,276	
Platinum, 1907.	41,988	Imp. 41,988	
Quicksilver, lb. ...	105,674	Exp. 105,674	
Quicksilver, '07	310,936	Exp. 310,936	
Aluminum, value	\$219,345	Exp. \$219,345	
Aluminum, 1907	208,534	Exp. 208,534	

Copper, lead and nickel include the metal contents of ores, matte, bullion, etc. The exports given include re-exports of foreign material. Zinc dross exported, 14,950,325 lb. in 1907, and 12,629,976 lb. in 1908. Zinc ore exported, 11,121 tons in 1907, and 16,728 tons in 1908. Zinc ores imported, 15,940 tons calamine and 10,440 tons other ores, 26,380 tons in all; not reported last year. Antimony ore imported, 1,882,783 lb. in 1907, and 709,769 lb. this year.

Wisconsin Ore Market

Platteville, Wis., Sept. 12—The base price paid for zinc ore this week was \$36 @37 per ton of 60 per cent. zinc. For 80 per cent. lead ore \$58@60 per ton was paid.

Shipments from the district, week ended Sept. 12:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Benton.....	646,900	65,610	.....
Highland.....	375,070	.....	.....
Platteville....	279,650	.....	.....
Cuba City.....	348,160	139,960	.....
Hazel Green....	243,300	.....	.....
Galena.....	149,900	.....	.....
Linden.....	113,110	.....	.....
Livingston....	110,000	.....	.....
Days Siding....	88,000	.....	.....
Harker.....	49,820	49,820	.....
Mineral Point..	24,000	.....	.....
Total.....	2,427,310	255,390	.....
Year to Sept. 12.....	67,391,801	7,811,345	1,318,204

Shipments of zinc ore are 250 tons per week greater than a month ago. The shipment from the mines this week was over 3,000,000 lb., of which 887,330 lb. of concentrates went to the Joplin Separator Works, at Galena, to be roasted, besides 88,000 lb. to the Enterprise roaster at Platteville. Ore thus sent to the separating plants at Galena and Platteville is not credited to the district's total until re-shipped from these plants in finished form.

Missouri Ore Market

Joplin, Mo., Sept. 12—The market opened the week with \$37 base warily offered, and considerable ore was picked

up at this price, the market taking a sudden upward spurt Thursday to a \$37.50 and \$38 base, and Friday reached a \$38.50 base price, with offers at \$38 base declined by a number of producers. The highest price was \$40 for 63 per cent. ore sold on a \$37 base offering. Silicate, on the other hand, was weaker, and, while a base of \$22.50 was rumored, the only known base was \$20 per ton of 40 per cent. zinc, with the high price at \$26.50. The average price, all grades, was \$33.92. The lead market opened the week at \$58, declining to \$57 at the week end, with medium grades selling at \$55@56, and all grades averaging \$57.90 per ton. Several hundred tons of zinc ore were withdrawn from the market after it became apparent there was increased activity among the purchasing agents.

Shipments from the various camps, week ended Sept. 12:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,279,940	739,830	\$80,492
Joplin.....	2,093,410	252,170	46,041
Galena.....	652,430	96,970	14,556
Miami.....	1,012,490	151,710	14,448
Prosperity.....	582,080	124,380	14,083
Badger.....	611,240	.....	11,862
Duenweg.....	400,960	70,090	9,249
Alba-Neck.....	502,950	.....	9,052
Granby.....	617,000	37,900	8,750
Oronogo.....	363,950	.....	6,692
Spurgeon.....	280,860	58,910	6,130
Carthage.....	292,080	6,290	5,724
Aurora.....	292,190	13,760	5,067
Zincite.....	144,470	1,110	2,630
Quapaw.....	166,920	1,700	2,384
Playter.....	58,970	20,880	1,606
Sarcoxie.....	76,810	.....	1,370
Carl Junction....	63,130	6,400	1,321
Cave Springs....	71,620	.....	1,217
Peoria.....	34,490	.....	345
Totals.....	11,627,990	1,582,100	\$243,019

37 weeks.....351,157,900 54,111,920 \$7,410,873
Zinc value, the week, \$197,211; 37 weeks, \$5,911,925
Lead value, the week, 45,808; 37 weeks, 1,496,948

Average prices of ores in the Joplin market by months have been, per short ton, as follows:

Month.	ZINC ORE.				LEAD ORE.	
	Base Price.		All Ores.		All Ores.	
	1907.	1908.	1907.	1908.	1907.	1908.
January.....	\$46.90	\$37.60	\$45.84	\$35.56	\$83.58	\$46.88
February.....	48.30	36.63	47.11	34.92	84.58	49.72
March.....	49.75	36.19	48.66	34.19	82.75	49.90
April.....	49.25	35.40	48.24	34.08	79.76	52.47
May.....	46.90	34.19	45.98	33.39	79.56	56.06
June.....	47.00	33.06	44.82	32.07	73.66	60.48
July.....	46.80	34.55	45.79	31.67	58.18	59.90
August.....	44.56	36.53	43.22	33.42	59.54	60.34
September....	41.00	.....	40.11	.....	53.52	.....
October.....	41.75	.....	39.83	.....	51.40	.....
November....	38.60	.....	35.19	.....	43.40	.....
December....	31.50	.....	30.87	.....	37.71	.....
Year.....	\$44.36	.....	\$43.68	.....	\$68.90	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Sept. 16—In certain branches of the chemical trade there is some activity, but in general the volume of business is small and irregular.

Copper Sulphate—The demand is good

and it is believed that prices tend to advance. Quotations are \$4.65 per 100 lb. for railroads and up to \$4.90 for smaller lots.

Exports of copper sulphate from the United States, seven months ended July 31 were 6,048,420 lb. in 1907, and 6,818,325 lb. in 1908; an increase of 769,905 lb. this year.

Nitrate of Soda—The market continues weak. Quotations for 95-per cent. grade, 2.20c.; 96 per cent., 5c. per 100 lb. higher.

Sulphur—Imports of sulphur into the United States, seven months ended July 31, long tons:

	1907.	1908.	Changes.
Sulphur.....	10,295	17,299	I. 7,004
Pyrites.....	367,694	418,830	I. 56,136
App. total sulphur.....	153,373	182,831	I. 29,458

Exports of sulphur for the seven months, 8989 tons in 1907, and 13,543 tons in 1908; increase, 4554 tons.

It is reported from Sicily that the Consorzio Obbligatorio has decided to suspend sulphur mining for three months, in order to work off part of the accumulated stocks.

Phosphates—Exports of phosphates from the United States, seven months ended July 31, long tons:

	1907.	1908.	Changes.
Crude.....	588,291	766,167	I. 177,876
All other.....	18,010	14,120	D. 3,890
Total.....	606,301	780,287	I. 173,986

The chief exports this year were to Germany, Great Britain, France and Italy.

Exports of phosphate rock through the port of Savannah in August, reported by J. M. Lang & Co.: Great Britain, 8810; Germany, 2170; total, 10,980 long tons.

Heavy Chemicals—Imports of heavy chemicals into the United States, seven months ended July 31, in pounds:

	1907.	1908.	Changes.
Bleaching powder	67,837,765	39,856,729	D. 27,981,026
Potash salts.....	139,687,962	118,290,834	D. 21,397,128
Soda salts.....	12,424,446	6,162,191	D. 6,262,255

Exports of acetate of lime for the seven months, 52,224,044 lb. in 1907, and 37,550,534 lb. in 1908; a decrease of 14,673,510 lb. this year.

Mining Stocks

New York, Sept. 16—The Stock Exchange this week has shown strength, but the movements still bear evidence of a professional rather than a general market.

On the Curb mining stocks were irregular, with small price changes, but some improvement on the whole. The copper shares were most in demand, with Nevada Consolidated and Cumberland-Ely the leaders. Cobalt stocks were dealt in to a considerable extent. The Nevada gold shares are not especially active.

Boston

Sept. 15—The mining-share market continues in a waiting mood, and prices are

off from a week ago, with few exceptions. Another mining dividend is announced, Utah Consolidated, and the rate is the same as the last payment, 50c. quarterly. Arizona Commercial has maintained a strong front. Declining \$1 to \$26.62 1/2, it rose to \$29.50 today. The bonds continue to hold well above \$120.

Amalgamated is off \$3.37 1/2 net for the week to \$76.37 1/2. Butte Coalition has fallen \$1.50 to \$25, Calumet & Arizona, \$4.50 to \$118; Copper Range, \$2.50 to \$76.50; Isle Royale, \$1.50 to \$22.50; Miami, \$1.50 to \$10.25; North Butte, \$3.50 to \$83, ex-dividend. The 528,000 shares of Utah Apex were taken from the Curb Sept. 10, and put on the unlisted department of the Exchange. The price, in the meantime, has advanced from \$4.37 1/2 to \$4.87 1/2. There has been quite a change in the directorate of this company, which is composed mainly of New England men with Charles A. Morse, of New York, besides a London member.

Calumet & Hecla and Osceola were strong features today. The former rose \$10 to \$650 on very limited trading, and the latter rose \$3 to \$113.

The Boston & Corbin Company may soon release 10,000 of the 20,000 shares of treasury stock around \$20 per share. The company has about \$25,000 in the treasury. La Rose has been the Curb feature, selling up to \$6.50 on active trading. Davis-Daly is off to \$2. A change has been made in the directors, J. C. Montgomery succeeding George W. Davis, to whom there was opposition.

STOCK QUOTATIONS

Table with columns for NEW YORK and BOSTON, listing various companies and their stock prices as of Sept. 15. Includes sub-sections for GOLD FID STOCKS and ASSESSMENTS.

N. Y. INDUSTRIAL table listing companies like Am. Agri. Chem., Am. Smelt. & Ref., etc., with their respective stock prices.

ST. LOUIS Sept. 12 table listing companies like Adams, Am. Nettle, Center Cr'k, etc., with their stock prices.

BOSTON CURB table listing companies like Ahmeek, Black Mt., East Butte, etc., with their stock prices.

LONDON Sept. 17 table listing companies like Dolores, Stratton's Ind, Camp Bird, etc., with their stock prices.

NEVADA STOCKS. Sept. 16. Furnished by Weir Bros. & Co., New York.

Table listing Nevada stocks and companies such as COMSTOCK STOCKS, BULLFROG STOCKS, MANHATTAN STOCKS, etc.

COLO. SPRINGS Sept. 12 table listing companies like Acacia, Black Bell, C. C. Con., etc., with their stock prices.

Monthly Average Prices of Metals SILVER

Table showing monthly average prices of silver in New York and London from 1907 to 1908.

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

Table showing monthly average prices of copper in New York and London from 1907 to 1908.

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Table showing monthly average prices of tin in New York from 1907 to 1908.

Prices are in cents per pound.

LEAD

Table showing monthly average prices of lead in New York and London from 1907 to 1908.

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

Table showing monthly average prices of spelter in New York, St. Louis, and London from 1907 to 1908.

New York and St. Louis, cents per pound. London in pounds sterling per long ton.