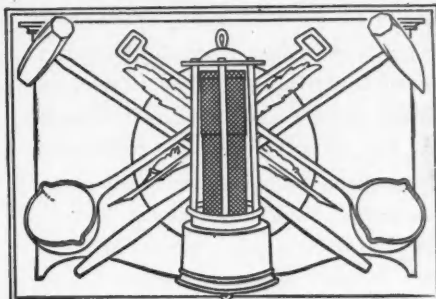


# THE ENGINEERING AND MINING JOURNAL

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## Production and Consumption of Spelter in 1909

In the JOURNAL of April 2, 1910, we reported our final statistics of the production of virgin spelter in the United States in 1909. We are now able to complete the record by reporting the production from scrap, dross and other waste products. The combined statistics appear in the accompanying table.

### PRODUCTION OF SPELTER.

(In tons of 2000 lb.)

Smelters.	1908.	1909.
1. Ore .....	210,511	266,462
2. Dross and scrap.....	12,150	14,568
Totals .....	222,661	281,030

These statistics require considerable explanation. The production of the ore smelters includes some metal derived from dross, the amount of which cannot easily be reported separately. The production credited to the dross and scrap smelters is doubtless incomplete, owing to small concerns that escape enumeration. Moreover, it is somewhat uncertain where to draw the line in the statistical accounting of their production. Some is re-smelted; some is merely remelted. When such spelter is marketed in slabs it plays the same part in the trade as does virgin spelter. In fact there is some spelter reproduced from waste products that is of superior quality as compared with virgin prime western. Besides the zinc that returns to the market in this way, a good deal of scrap zinc is utilized directly in the manufacture of such chemical products as zinc chloride, zinc sulphate and lithophone. This is not statistically accounted.

In previous years we have reported the domestic consumption of spelter accord-

ing to purpose upon the basis of reports made by the consumers. These reports have covered the major part of the consumption. It has not been possible to secure reports from some consumers of zinc for brass-making and for miscellaneous purposes, but with nearly complete reports for galvanizing and sheet zinc and assuming that consumption was equal to deliveries it was possible to supply missing returns by difference. For 1908 and 1909, however, this was impossible, the consumption in those years having been materially less than the deliveries, as is well known. Our reports for consumption in 1908 and 1909 are consequently to be regarded more in the nature of an estimate than have been those of previous years. As an indication of the basis of estimate, however, we may say that the returns actually received for 1909 aggregate 134,607 tons. Our estimate of consumption is given in accompanying tables.

### CONSUMPTION OF SPELTER IN THE UNITED STATES.

(In tons of 2000 lb.)

Purpose.	1908.	1909.
Galvanizing .....	119,000	164,000
Brass .....	33,000	48,000
Sheet zinc.....	27,000	33,000
Lead desilverization.....	2,500	2,600
Other purposes.....	10,000	14,000
Totals .....	191,500	261,600
Deliveries .....	228,785	301,634

### PERCENTAGE OF CONSUMPTION.

Purpose.	1908.	1909.
	Per Cent.	Per Cent.
Galvanizing .....	62.2	62.7
Brass .....	17.2	18.3
Sheet zinc.....	14.1	12.6
Lead desilverization.....	1.3	1.0
Other purposes.....	5.2	5.4
Totals .....	100.0	100.0

The statistics for consumption both in 1908 and 1909 are probably under the true totals, but even after making allowance for the tendency of statistics that have to be collected from a multitude of

small consumers to fail by omissions, there is nevertheless no doubt that in 1909 the actual consumption fell short of the deliveries by an even greater amount than in 1908. This means that at the end of each year the galvanizers, brass-makers, etc., had supplies to large amount in their yards and possibly spelter may also have been in warehouse for speculative accounts besides that which was carried at the smelteries. It is especially the time required for the digestion of these invisible supplies that accounts for the low range of spelter price during the last two years, relieved only by the fitful rise in 1909 when it was feared that the Payne tariff was going to reduce ore supply.

The actual consumption of spelter has increased largely, the amount in 1909 being the largest on record, but the production has been too big. The spelter business is in fact in precisely the same situation as the copper business, except that in copper the major part of the accumulated surplus is "visible," whereas in spelter the reverse was the case at the end of 1909 and probably now also.

### Copper Statistics

We seldom undertake to prophesy the reports of the Copper Producers' Association, but it is reasonably safe to say that the statement for June will show an increase in the visible accumulation in this country. As to what the combined figures for America and Europe will show is another matter. We are referring to this subject at present in order to point out once more that, while these statistics are illuminating and valuable, and something for which the industry ought to be duly thankful, nevertheless they should not be made the basis for deductions of too great refinement, and certainly not by persons who are inexpert in the industry. This will appear, we think, by a consideration of some anomalies and omissions in the statistics.

The statistics of the Copper Producers' Association are based upon refined copper. They disregard the rough copper at the smelteries and refineries, and in transit between them. The production figures include the copper, about 1,000,000 lb. per month, refined from scrap and junk, but do not include the production of about 3,000,000 lb. per month by the

concerns that confine their attention to business in scrap and junk.

The European statistics cover supplies, deliveries, and stocks. These statistics include more or less rough copper, along with the refined and "standard," and consequently are not compiled upon the same basis as the American figures. The report of stocks comprises copper in warehouse at British depots and in certain French ports. The copper at other European ports is not counted, though there is apt to be a considerable supply at Antwerp, Rotterdam and Hamburg. The copper arriving at those ports is apparently entered with the supplies and checked out at once as deliveries, the deliveries going partly to manufacturers and partly into warehouse.

Among the supplies reported in the European statistics is included the copper afloat from Chile and Australia, but the copper afloat from America, almost always as large in amount, is not included, although it is a part of the visible supply.

In order to determine actual consumption, it is necessary to know about what is technically called the "invisible" supply of refined copper. This includes unreported copper in warehouse, as at Antwerp, Rotterdam and Hamburg, and copper in the yards of manufacturers. Over a fairly long period of time, deliveries may be fairly taken as corresponding to consumption, but in considering the figures for a month, a semester, or even a year, the variation may be so considerable as to be misleading. Thus, we think that, although during the last five months there has been an increase in the visible supply, indicating production in excess of consumption, as a matter of fact, the reverse has been actually the case.

The form in which the stock of copper exists is also a consideration of some importance. The first form in which electrolytically refined copper appears is as cathodes, which are a marketable form. Not very much goes into consumption in that shape in the United States, but a good deal of cathode copper is exported to Europe. However, for many purposes manufacturers require ingots and wire bars, and require them to be of certain specifications. Thus it may happen that although there be a large stock of refined copper in Europe and a small stock in this country, with the European price a little below our parity, we may still sell copper for export to meet specifications that cannot so easily be supplied abroad.

Sales of copper do not imply deliveries right away, either domestically or for export, and *vice versa* deliveries do not imply cotemporaneous transactions. Manufacturers do not generally buy from hand to mouth, and the sale of copper is usually in contracts for future deliveries. The copper exported on one day may have been sold three months previously.

### Goldfield Consolidated

In his management of the Goldfield Consolidated, J. R. Finlay is exhibiting himself as a man who practices what he preaches. Before entering upon this position he had put himself on record in favor of complete publicity respecting the affairs of public companies, and of starting the real cost of production rather than the partial or imaginary cost, wherein many operators deceive themselves and their followers. The Goldfield Consolidated, under Mr. Finlay's management, has been making monthly reports to its stockholders that other mining companies may well adopt as their model. The cost of production is stated in what we may call its penultimate term; not the ultimate, because the necessary allowance of liquidation of assets is not made, but that is something which the stockholders must do for themselves and is outside the province of the mine manager, who has done his full duty when he has given the stockholders all available data for their own estimates in this respect. The statement of the real cost of production by the Goldfield Consolidated involved a rude transition from the previous method, but this was bravely met.

The latest step by the Goldfield Consolidated is the inauguration of an improved system for the protection of its employees against accidents. Mr. Finlay is a member of a committee that is about to make a report upon this question, affecting the mining industry broadly speaking. Without waiting for discussion and legislation, the Goldfield Consolidated of its own volition has put into effect rules and regulations that experience and common sense have shown to be wise. This will put exceptional emphasis upon the forthcoming report of the committee above referred to and affords also another example that may well be emulated by mining companies.

# CORRESPONDENCE and DISCUSSION

Views, Suggestions  
and Experiences of Readers

## Shaft Plumbing

In the JOURNAL, June 4, an article was published on a "Modern Method of Plumbing a Shaft," which contained several points calling for criticism. In the first place, it is difficult to line in the wires at the surface, with sufficient accuracy. It must be remembered that an error of 0.01 in. in the position of a wire, when the wires are 3 ft. apart, introduces a one-minute error of azimuth. The wires should first be lowered, and the plummets hung on and adjusted, before any observations are made, as nothing is more annoying than for the wires to break after one-half of the sights have been taken. The transit is then set up on surface, and lined in with the wires; its axis being located by a peg in the ground, or by means of a "temporary center." The temporary center consists of a lead disk, 3 in. in diameter and 1 in. thick, and slightly concave on the top and painted white. In the center of this surface is cast a small carpet tack, point upward. This point can be accurately placed under the plumb-bob hung from the transit. Care must, of course, be taken to insure that this center be not kicked or otherwise moved while the work is in progress.

By the time the surface operations have been made, the plummets at the shaft bottom will have come to rest, and the underground observations can be quickly taken. If there are strong air currents or much falling water in the shaft, an 18-lb. plummet is not heavy enough; one weighing 50 to 60 lb. is preferable, hung on steel piano wire. When using iron plummets, care must be taken that there are no masses of iron near the shaft bottom, such as piles of rails or iron pipes, which could become magnetized, and cause the wires to be deflected.

There is no necessity, underground, for the transit to be placed as much as 50 ft. from the wires; it may with advantage be placed as near to them as the telescope will focus, which, with the ordinary mine transit, is about 10 ft. In this case there is no necessity for a ring in the rear wire, since only one wire is in focus at a time. The only extra precaution to be taken is to insure that the line of collimation is the same, when the telescope is focused on objects at different distances. The use of the temporary center is a great convenience and time-saver underground as drilling a hole in the roof above a set-up instrument is neither an easy nor a safe proceeding. A "shaft plumbing" is one of the most deli-

cate operations which a mine surveyor is called upon to perform, and too much attention cannot be given to details, if an accurate result is desired.

T. B. GREENFIELD.

El Oro, Mexico, June 20, 1910.

## Protective Alkalinity in Cyanide Solutions

Articles in the JOURNAL of March 12, page 560, and May 28, 1910, page 1101, call attention to an error which may be introduced in the estimation of protective alkalinity if iodide indicator be used; moreover, phenol-phthalein indicator has the disadvantage of being affected by ammonia, of which there is generally more or less present in mill solutions.

The following method of estimating protective alkalinity was devised by me in 1901 and used in various parts of the United States. I am not aware that any one had previously used it, or whether it has ever been published. It is not mentioned in Clennell's earlier work,<sup>1</sup> so that it seems likely that it was not generally known at that time.

It is assumed in this method that "free cyanide" is the active solvent which is to be protected against acid action, and that in presence of zinc all other alkaline substances exercise a protective influence.

### METHOD OF ESTIMATING PROTECTIVE ALKALINITY

Determine the "free cyanide" by titration with silver nitrate, using neutral potassic iodide indicator. In another portion determine the "total alkalinity" by titration with 1/10n sulphuric acid, using methyl-orange indicator. Subtract the alkali equivalent of the "free cyanide" from the "total alkalinity," the result is the "protective alkalinity."

The alkalinity values are most conveniently expressed in terms of CaO, as equal to so many pounds of lime per ton of solution, lime being the alkali generally used to secure a protective alkalinity. 1 c.c. 1/10 n, H<sub>2</sub>SO<sub>4</sub> = 0.0028 gram CaO = 0.1 lb. CaO per ton on a 56 c.c. test. 1 c.c. 1/10 n, H<sub>2</sub>SO<sub>4</sub> = 0.0065 gram KCN, therefore 65 KCN = 28 CaO, or 1 KCN = 9.43 CaO.

Therefore, multiply the pounds KCN per ton found by the silver nitrate titration by 0.43, and subtract the result from the pounds CaO per ton found by the acid titration. The result is the protec-

tive alkalinity in terms of pounds CaO per ton.

I have found this method to give in practice a reliable indication of alkalinity, the solutions working properly as long as the test showed protective alkalinity, but when the test showed none, or an acidity, the solutions were acid and worked badly.

I may mention that I have found the "Schuchardt" methyl orange far superior to most brands for use on mill solutions, as it will give a distinct point with foul solutions which some others will not, though they give a good enough end point on fresh clean solution.

RALSTON BELL.

Edinburgh, June 6, 1910.

## Rapid Method for Determining Copper in Slags

A. W. Diack and Thorn Smith have stated that the "Rapid Method of Determining Copper in Slags" published in the JOURNAL of December 25, 1909, is open to two criticisms, as follows: (1) Does it precipitate all of the copper on aluminum? (2) Will not the slight amount of gelatinous silica which we have found almost invariably present interfere with the filtration, assuming as we do, that most chemists will prefer to decant through a filter paper?

When the method was first put into practice it was the custom to treat the combined decantations with hydrogen sulphide, boil and filter. The additional copper thus recovered did not affect the results when the iodide or cyanide method was employed for final determination. It possibly would have affected the results in the third decimal place had the electrolytic method been employed. After a few weeks the practice of adding hydrogen sulphide and filtering was discontinued, as it was found that all copper was recovered provided that the solution had previously been boiled until the aluminum appeared clean and the precipitated copper detached from it.

The method was designed for furnace control and the aluminum precipitation employed for the express purpose of avoiding filtration.

This question of complete precipitation of copper on aluminum springs up periodically for discussion, and is of considerable importance in the copper industry in view of the fact that most copper methods employ this means to effect the preliminary separation.

<sup>1</sup>"Chemistry of Cyanide Solutions," 1904.

Nitric acid is the most common solvent for copper-bearing substances, and failure to obtain precipitation can be attributed to lack of precaution in subsequently expelling this acid and decomposing all nitrates. In the particular method under discussion, no nitric acid is used in the preliminary separation.

That the method has attracted the attention of such well known chemists as Messrs. Diack and Smith, is additional proof to me that it possesses merit and I beg to thank them for their kind criticism.

F. D. ALLER.

Antofagasta, Chile, May 18, 1910.

### Indifference to Mining Laws

In the JOURNAL of June 4, 1910 is quoted the verdict of the coroner's jury on the Cherry mine disaster, as follows: "We find that they (men who lost their lives in the third seam) came to their death by exposure and suffocation. We further find that the mining laws of the State of Illinois, in relation to means of escape were violated with the full knowledge and consent of the mine inspectors for district No. 2."

This condition of non-enforcement of the mining laws is all too common in other coalfields and coal-mining States, as well as in the Cherry mine in Illinois, and the wonder is that more "accidents" do not occur.

#### INDIFFERENCE OF MINE BOSSES TO SAFETY REGULATIONS

A year or so ago I went through a mine in Ohio for the purpose of giving testimony in a suit between two adjacent coal companies. I found a patent trap door standing wide open. This had been purchased and installed on the recommendation of the chief mine inspector and all his associates, the object being to do away with the trapper boy. The mine boss was with me and I asked him what it meant. "Well," he said, "that door cost the company \$150. "There was a strong current of air passing through on a short circuit, and I said to the boss, "Why don't you repair it, or put in another door?" "Well," he retorted, "if the mine inspectors want to put in a new door, they can do so, but the company has no more money to spend on trap doors recommended by the mine inspectors" Many of the miners were found working in an atmosphere unfit for a dog. Fortunately, the mine generated no fire-damp, otherwise the consequences might have been as disastrous as at the Cherry mine.

#### TOO MUCH LEGISLATION

When an accident occurs the inspectors clamor for more laws until every coal-mining State has laws longer than

the Constitution of the United States. Laws enacted for the proper security of our subterranean workmen exist to no purpose if the inspectors have not the ability or the will to enforce them. The annual death rate of coal miners in the United States is several times greater than that of the principal coal-mining countries of the world. The more laws, the more accidents, seems to be a foregone conclusion. Conditions could not be worse; they might be better if there were no inspectors at all.

The recently created Bureau of Mines will no doubt do much good. While the Government cannot act directly without encroaching on the rights of the States, the officials of the bureau will be men of scientific attainments, and their suggestions are sure to result in great good.

ANDREW ROY.

Agujita, Coahuila, Mex., June 10, 1910.

### Spurious Potassium Cyanide

Ralston Bell's contribution to the JOURNAL of May 21, 1910, under the above heading, is logical, well balanced and to the point. It is, in fact, precisely the style of discussion that I hoped to draw out by my article of Oct. 23, 1909, inasmuch as it leads directly up to the question before the house, namely: Shall we continue to receive highly adulterated and mixed salts of sodium and potassium from the makers although we desire, order and pay for commercially pure potassium cyanide? All metallurgists seem to agree that there is urgent need for reform in the standardizing and marketing of this important salt. In the JOURNAL of March 19, 1910, W. J. Sharwood says: "The fundamental absurdity consists in reporting the valuable constituent of a substance in terms of an arbitrary unit." Others propose different systems but, as Mr. Bell says, the fact remains that under the present system a manufacturer may point with pride to the fact that his product "tests 100 per cent." and yet analysis shows the presence of large percentages of adulterants that may or may not be harmful but which, in any event, are not worth the price charged and collected therefor. Mr. Bell's criticism of the manner in which the original results under this discussion were reported has been anticipated by my contribution of April 2, 1910, under the above heading.

F. A. ROSS.

Spokane, Wash., June 20, 1910.

The companies engaged in treating the zinkiferous tailings in the Broken Hill field furnished an output of the gross value of £870,852, which brings the value of the production of the Broken Hill field, for the year 1909, up to £3,482,041, as compared with £3,831,104 for the previous year.

### Copper Production

The following views and statements are interesting and illuminating. Thompson, Towle & Co. report that one of the largest manufacturers in New England, who consumes a large amount of copper, says: "I have been manufacturing and selling goods for many years, but I have never talked about how cheaply I could manufacture my goods or how cheaply the other fellow was manufacturing them. The opposite seems to be the policy of the copper producers. They are continually talking about how cheap one company can produce copper compared with another company. As a matter of fact, I question very seriously if any of the companies can afford to sell a pound of copper at 12c. per lb. Of course, I appreciate that there is an object in some of the large porphyry producers outputting copper to the limit and talking about their low cost."

Hayden, Stone & Co. said under date of June 24: "Regarding this company (Utah Copper Company) we can state that the present output will not be increased for a period of from three to four months, and we do not figure that the output, which, at the present time, is from 12,000 to 13,000 tons of ore daily, will be increased to more than 15,000 tons before the first of next year. The improvements in the Magna plant that are being made will enable that mill to treat 10,000 tons or more daily, within 90 days, but by that time portions of the Arthur plant (Boston Consolidated) will be closed down for remodeling and the capacity of that plant thereby reduced from a quarter to one-third, so that there will be no actual increase in the total mill capacity until the remodeled portions of the Arthur plant begin to go into commission toward the first of the year, and the Utah Copper will do well to work up to its full contemplated capacity within one year from date.

"We do not anticipate that the estimated production will exceed 9,000,000 lb. gross per month before Jan., 1911. If the work of construction and the necessary additional opening up of the mine progresses satisfactorily during the balance of the current year, the company should, by Jan. 1, next, begin to make a uniform monthly rate of increase in its production over the present rate, reaching the contemplated daily output of 18,000 tons about next May or June.

"The Ray Consolidated Copper Company will not begin production until January, 1911, and its production will then be small and will not be in the market as copper before April, and the full production from that property cannot possibly be on the market before August or September of 1911.

"Chino will not begin producing for a year from date, and the full production

of that property will not be on the market before Jan. 1, 1912.

"It is a great mistake to suppose, as some apparently do, that it is the intention of the managements of these low-grade porphyries to flood the market with the greatest possible amount of copper, especially with any idea of forcing down the price of the metal and driving any companies less fortunately situated in the matter of costs out of business.

"The porphyry mines are in business to make money, and they will operate to such a capacity as will enable them to obtain the lowest possible cost, but to force any extra amount of copper on the market, under present conditions, beyond what we might call the limit of operating efficiency, with the express idea of lowering the price of the metal, would be simply 'hitting their nose to spite their face.'

"Any hopes on the part of the consumer, or fears on the part of copper-share investors, based on this premise, are groundless."

## Geological Survey Appropriations

WASHINGTON CORRESPONDENCE

Members of the Geological Survey are congratulating themselves upon the general outcome of the controversy about appropriations, as already reviewed in these columns. The Survey now comes out of the session with a gross addition of about \$125,000 as compared with its appropriations for last year. Of this, some \$50,000 is additional money for stream gaging. The comparisons are, of course, made after eliminating those for the Technologic Branch of the Survey and for the testing of structural materials. These branches of the work have now been transferred to the Bureau of Mines and the Bureau of Standards, so that the sums appropriated to them should not figure in making comparisons of the money spent on the Survey itself.

### GEOLOGICAL SURVEY BUILDING

In putting through Congress the public-buildings bill the provision for a building in Washington designed to house the Geological Survey and several allied bureaus has been retained on substantially the basis proposed in the original public-buildings authorization measure. The bill, however, does not carry actual appropriations but merely authorizations for buildings at various places and for various purposes. The Survey, nevertheless, is peculiarly fortunate in having left the sum of \$96,000 from the purchase of the land to be used as a site. By the terms of the appropriation this money left over from the appropriation for the land is now made available for immediate use in connection with the new building and this makes it possible to go ahead at once with the getting of plans and speci-

fications. This will be done, although the conditions do not warrant doing any preliminary work on the building as yet.

## Internal Commerce During May, 1910

Leading commodity movements in the domestic field during May, as reported to the Bureau of Statistics of the Department of Commerce and Labor, in several instances present a more favorable picture of trade activity than for the previous month. This is true especially of the lumber and coal trades. The volume of building operations shows a considerable check, mainly in the largest cities. The traffic activity of the railroads was rather light, the number of idle cars showing a steady increase since the beginning of the year.

Anthracite-coal shipments during the month from eastern producing territory, 5,679,601 gross tons, were fairly heavy, though falling below the May totals reported in 1905 and 1908. The total shipments during the five months of the year, 27,416,565 gross tons, is the largest total ever reported to the bureau for the period in question. The monthly shipments of bituminous coal over seven leading eastern coal-carrying roads, 7,091,663 net tons, show a decided improvement over the figures of the preceding month, as well as the corresponding monthly figures in 1909 and 1908, when 5,929,687 and 4,743,860 net tons were reported. The coke movement during the month, 1,859,806 net tons, while considerably in excess of the corresponding 1909 and 1908 figures, shows, however, the effects of the curtailment recently enacted. The bituminous-coal tonnage of the same roads for the first five months of the year, 34,912,304 net tons, was almost 20 per cent., while the coke tonnage was more than 25 per cent. larger than the year before.

The estimated coke production at Connelville for the four weeks in May, 1,580,819 net tons, although proceeding at a slackened rate, shows an increase of almost 50 per cent. over the May figures of the preceding year. The pig-iron production during the month, 2,390,180 gross tons, shows a recession in furnace activity though the smaller monthly total exceeds the totals for any month in 1906 and 1907.

The decreased activity in the building trades is indicated by the comparative values of building permits granted by 104 municipal authorities in various parts of the country, the May figures, \$76,255,637, indicating a decrease of 15.6 per cent. from the previous months and over 17 per cent. from May of the preceding year.

The traffic activity of the railroads, as measured by the number of cars handled by 30 car-service associations and demurrage bureaus, also shows an unfavorable turn, the May figures of 2,544,197 cars

indicating a daily average of cars handled slightly below the like average for April. The total number of cars handled during the first five months of the year, 12,538,781 cars, was about 20 per cent. in excess of the corresponding 1909 figures and almost 40 per cent. in excess of the corresponding 1908 figures.

## The Nova Scotia Steel Company

The contest for the control of the Nova Scotia Steel Company has gone over for a time, the contesting stockholders having met with temporary defeat. It is understood, however, that they have not given up, but are preparing for another effort next year. The company has made and is making many improvements and extensions, and is already an important factor in the Canadian iron trade; which, by the way, is being gradually consolidated into a few large corporations.

The contest for control is based largely on the management of the large ore deposits which the company owns on Wabana Island in Newfoundland. These deposits are proving much larger than was at first supposed, and the workings are being extended to large submarine areas beyond the surface limits of the island, presenting some interesting problems in mining.

The opposition party headed by Mr. Forget, of Quebec, object to the large sales of this ore made to the United States by the company, claiming that the reserves should be held for its own use, or at any rate for Canadian benefit; such use being more important than the small present profit on the sales.

## Mining in Panama

Within the last two years much attention has been directed to the development of the mining industry in Panama. The latest figures available to this effect are published in the *Anuario de Estadística* for 1908 in which is announced that 149 titles to properties were issued, comprising 229,830 hectares of auriferous land.

Mining properties represent a total of 237,211 hectares. In the Province of Panama there are five gold mines and in that of Veraguas four are being exploited. Besides these there are three gold-silver mines; 18 gold-lead mines; two silver-lead mines; eight copper mines; one iron mine; one asbestos mine; one silver and two sulphur mines.

The Terre Neuve Mining Company has been organized at Port au Prince, Haiti, for the purpose of exploiting the copper and iron mines of Terre Neuve, Gros, Morne, and Gonaives, and other mineral land, for which it may subsequently obtain concessions.

# DETAILS of PRACTICAL MINING

Notes of Interest to Prospectors and Operators of Small as Well as Large Mines. Things That Have to Be Done in Everyday Mining

## Mine Ventilation Through a Drill Hole

In underground operations it is necessary to have two openings in order to insure good ventilation. The second opening is generally made by sinking a new shaft. In the case cited here, the ore could be handled readily through one shaft, and a churn drill hole was used for the second opening.

The apparatus is a fan about 2 ft. in diameter with a horizontal bottom discharge 8 in. in diameter. To this nozzle is fastened a short piece of canvas air pipe slightly larger than the casing of the

they lose if they can gain threepence in the air costs. To me it appears that the machine that drills a few feet more per shift is the one to be after, even if air costs are 20 per cent. higher. For instance, air costs per machine shift are, say, 6s.; then say 30 per cent. is leakage, etc., leaving 70 per cent. against the machine itself. This equals 4s. 3d. The machine drills 24 ft. per shift and breaks  $\frac{2}{3}$  fathom of ground.

Now suppose we change the machine and use one that takes 50 per cent. more air, making the cost 6s. 4d. against the machine itself. Leakage will be the same and how much more work must the new

job to keep the machines in fair running order, have two and keep the machines in good order, the total cost being the point to watch. Let any individual item rise if by so doing the total is lowered.

## Large Underground Station in a Coeur d'Alene Mine

One of the largest and most complete underground timber, boiler and hoist stations in the country is just being completed at the Morning mine of the Federal Mining and Smelting Company, Mullan,



MINE VENTILATION THROUGH A DRILL HOLE

drill hole with which it connects. The fan is belt-driven by an 8-h.p. upright engine. The engine obtains its steam from the boiler at the shaft several hundred feet distant. The apparatus is in an open field in the southwest part of Joplin, with no protection from the weather.

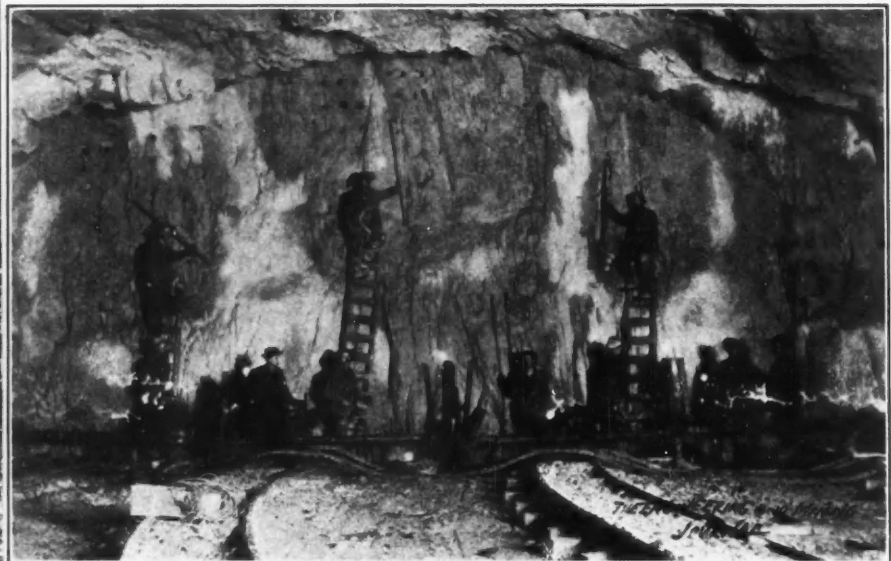
## Importance of Air Cost in Machine Drilling\*

BY THOMAS JOHNSON †

There has been quite an amount of talk about machine air costs, and it seems that some people are as mad about this so called economy as they are about running three or more machines per man. They do not bother about the half crown

\*Excerpt from an article in *Journ. Chem., Met. and Min. Soc., of South Africa*, February, 1910.

†Mine manager, Johannesburg, S. A.



BARs RIGGED END TO END ACROSS FACE OF MORNING STATION

machine do to pay for its extra cost? To get at this we must know the total cost of breaking ground per fathom. This we will take at say, 70s.; even with the three machines per man, 70s. equals 46s. 8d. per shift or 1s. 11.3d. per ft.; so to pay for the 50 per cent. increase of cost of air for the machine we need only another foot of drilling from the machine, despite all the worry about getting a machine to save air.

I think looking at the air costs alone is wrong if we really wish to lower the machine costs. The same reasoning applies to whatever machines a mine may be using. Do not worry particularly about the cost of air per machine shift, but look to the cost per fathom, and strive to get the best from the air. Do not let your machines get into the rattletrap stage, but spend money on keeping them in order. If one machine fitter has a hard

job to keep the machines in fair running order, have two and keep the machines in good order, the total cost being the point to watch. Let any individual item rise if by so doing the total is lowered.

Its construction involved several interesting mining problems. The station is situated at a point nearly two miles from the entry of the No. 6 tunnel, now the main haulage way of the Morning mine. In this tunnel electric haulage is used, ore being handled in trips of fifteen 5-ton cars. About 1000 tons of ore are produced each day and, practically the entire output will pass through this station. Ample space for the handling of the ore and timber trains was therefore a prime requisite in the laying out of the station.

The station proper is 100 ft. long, 36 ft. wide, and is 24 ft. high in the clear at the shaft, dropping to a height of 11 ft. at a point 200 ft. distant. There is a wide double-track approach. A room, about 28x19 ft. in size, in which boilers will be set opens off from the farther end of the station. At

present steam and air are piped into the mine a distance of a couple of miles. After the new station is completed, only air will be piped in and run directly into the boilers and there reheated by being mixed with steam. Adjoining the boiler room is the hoisting-engine room, 30x47 ft. in size.

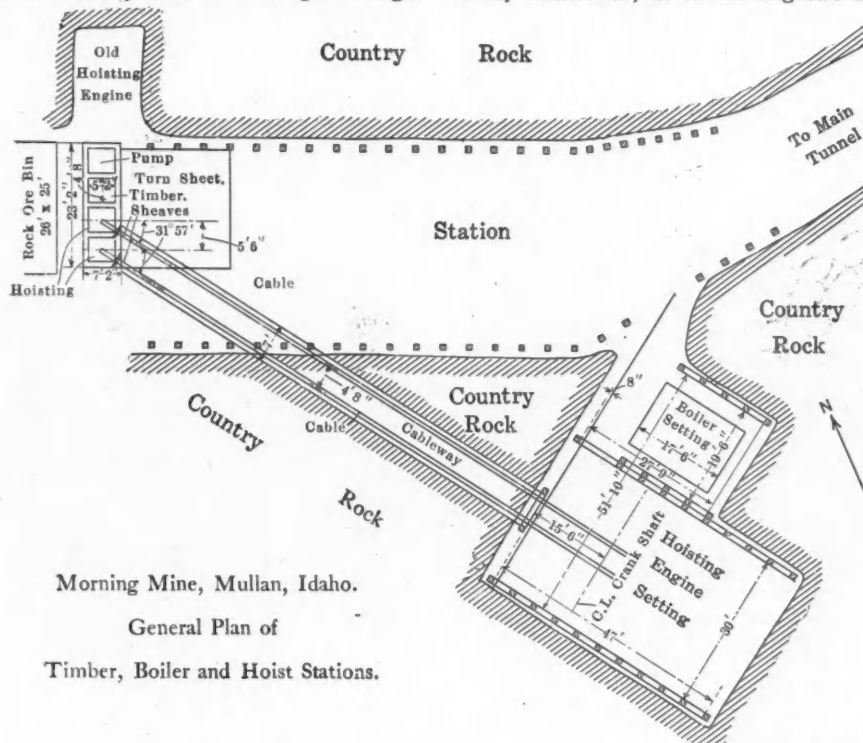
**HOISTING ENGINE SET AT INCLINATION TO SHAFT**

An interesting problem arose in connection with the placing of the engine. A shaft with compartments, 4 ft. 8 in. x 5 ft. 2 in. in the clear had been decided upon, and this would throw the sheave wheels 5 ft. 6 in. apart. It was, however, deemed wise to use an engine similar to that in use at the Mace mines in order to facilitate repairs, etc. The reels on this engine are spaced 4 ft. 8 in. apart. For a while this promised to make trouble, until the expedient of setting the engine

to the long axis of the shaft); it is 25 ft. wide and 52 ft. from toe to top, the bottom having a 45-deg. slope. This bin was excavated out of solid rock and is armored on the front inside face with 60-lb. rails. Skips will automatically dump ore into the bins from which it will be drawn directly into the 5-ton cars of the electric trains.

**FOUR DRILL BARS USED END TO END**

In cutting out the station some interesting rock excavation was done. The face was advanced carrying its full height and width. To do this four 10-ft. bars set end to end and blocked tight with 3-in. planking were used across the face. The line of bars was arched slightly toward the face, from which it was braced with the wedge timber. This formed a "compression" truss and although many miners object to running two ma-



Morning Mine, Mullan, Idaho.  
General Plan of  
Timber, Boiler and Hoist Stations.

off at an inclination to the axis of the shaft was hit upon. The crank shaft of the engine will be 111½ ft. from the center of the shaft and inclined from its long axis at an angle of 31 deg. 57 min. This throws the sheaves at the proper distance apart.

**INCLINED RAISE FOR CABLEWAY**

The cableway from the engine to the sheaves is an inclined raise through solid rock so that no headframe structure is required. From the collar of the shaft to the center of the sheaves is 100 ft.

An old hoist set in line with the long axis of the shaft will handle timber. (The sheave for this is only 45 ft. above the collar of the shaft.) The general layout of the station is shown in the accompanying plan.

Five feet from the wall plate of the shaft is an ore bin 26 ft. long (parallel

chines on a bar, on the score that the bar will not hold tight, three or four machines were continually operated on this series of bars, and no special trouble was experienced from fitchered holes. For this work 3¾-in. piston drills were used, and as many as 190 eleven-foot holes put in to a round. The cuts and lifters were fired first, then the other holes. Electric battery firers were used in all cases.

One round of holes usually broke enough rock to fill 400 of the 35-cu.ft. capacity cars. Only two settings of the bars were necessary for drilling the entire face: The first was on the muck pile and the second lower down after the face had been mucked clean. The photograph published herewith shows the station with the bars arched against the face. The upper ground had already been drilled and the muck cleared away before the machines were set up as shown.

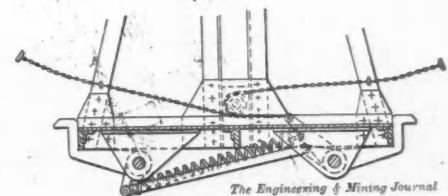
**Landing Chairs for Mine Cages \***

By J. C. HOUSTON †

The landing chairs which I designed for some of the mines in Cobalt overcome most of the objections to the ordinary type. The chairs are permanently attached to the cage, of which they form a part, and it is only necessary to have the one set, no matter how many levels may be in use. They require no auxiliary apparatus, no cutting away of timbers, and if it be necessary to repair timber or guides at any intermediate point in the shaft, the cage may be landed on any set of timbers for that purpose, since the chairs may be operated from the cage or from either side of the shaft.

**CONSTRUCTION OF CHAIRS**

The apparatus consists of four chairs, one at each corner of the cage bottom, swung on two jack shafts that rotate in bracket bearings underneath the floor of the cage. The two shafts are connected



LANDING CHAIR ATTACHED TO CAGE

with levers and connecting link, so that they move together but in opposite directions. A lever projecting through a slot in the floor at one side of the cage, is keyed to an end of one of the shafts. To the end of this lever are attached two pieces of 3/16-in chain, which lead over a pulley fastened to the vertical angle bars, and back through an eye bolt in the diagonal brace and ending in a pull or handle. The cage tender catches the pull as the cage is slowing up to land and pulls it in a direction toward himself. This operation, acting through the levers and jack shaft, swings the chairs out simultaneously and the cage comes to rest on them flush with the landing. This may be effected from either side of the shaft or while riding on the cage.

**CHAIRS AUTOMATICALLY RELEASED**

The chairs are not rigidly keyed to the shaft, but have a radial slot cut in the hub, provided with a ½-in. pin that is fastened solidly in the shaft, and allowing the chair to move, one-quarter of a revolution, independently of the shaft. This provision prevents the fouling of the chains. As soon as the hoistman lifts the cage, the coil spring instantly forces the jack shafts and chains to the set position,

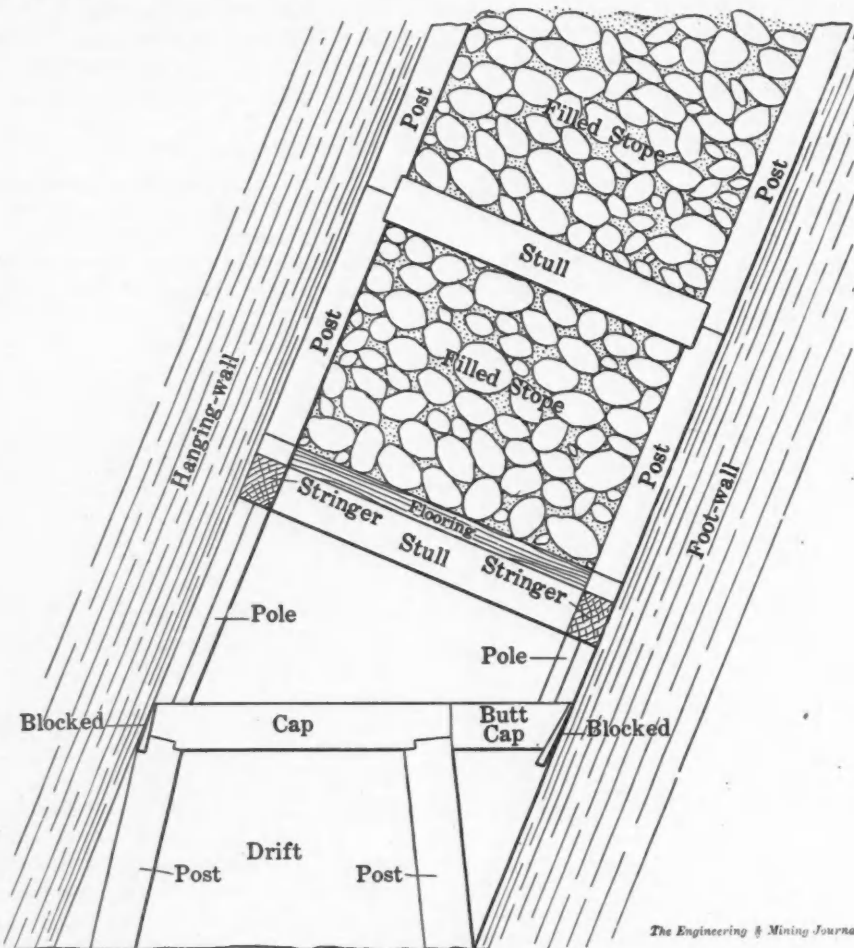
\*Extracts from a paper in April Bull., Canadian Mining Institute.  
†Cobalt, Ontario.

permitting the chairs by their own weight to drop and swing beneath the floor of the cage out of the way.

Several of this type of chairs have now been in use in the Cobalt camp for two or three years and have not only given complete satisfaction, but have proved to be economical both in respect of outlay and of time.

### Leaning Stope Sets

In the Argonaut mine at Jackson, Cal., and to a less extent in some of the other Mother Lode mines, leaning sets re-



LEANING STOPE SETS USED ON MOTHER LODE

place the usual square sets in stopes up to a width of 16 ft., which is the full length of the ordinary stull. The advantage of the leaning over the square set is in the fact that posts can always be set directly above each other. In the Argonaut the veins dip at such an angle that it is almost impossible to get in square sets so as to have posts rest on posts in the short space of time that the ground will hold. Simple stull timbering without posts would not hold the walls, which are blocky and in many cases must be lagged.

The so called leaning sets are really stull timbering with posts and girts added. Or, from a different viewpoint, square sets of variable width, placed

with the posts parallel to the walls of the orebody instead of vertical. The standard sets are framed of 8-ft. posts and caps and 4-ft. sprags or girts. Round stull timber is generally used.

The greatest amount of pressure is from the swelling of the walls, and to take up this the posts are usually given a horn from 4 to 8 in. square. The sprags are not framed.

The usual method of timbering drifts below leaning sets is shown in the accompanying sketch. In general, two stringers, one on either wall, are blocked up from the drift set and separated by a stull. They are wedged into posi-

tion and the swell of the walls soon holds them so firmly that they will support the filled stope above, even after the drift sets below are removed.

On the Kolmanskop diamondfields, German Southwest Africa, the directors of the Kolmanskop company realized that to maintain profits with lower-grade ground, the costs must be decreased. This was done, with the result that sand which cost 6s. 4d. to handle in April, 1909, cost only 2s. in December, and the gravel cost was reduced from 12s. 8d. to 6s. All of which would seem to prove that mining costs are largely governed by necessity.

## Variables Influencing Cyanide Plant Design

BY MARK R. LAMB\*

I attach a list of the main points which must be taken into consideration in the design of a cyanide plant. The list may not be entirely clear due to briefness, so I append some explanatory remarks. This is not offered as an "Every Man His Own

### CYANIDE PLANT VARIABLES.

<b>ORE</b>	<b>SAND LEACHING</b>
quartz	separation
conglomerate	collection
wet or dry	tonnage
hard or soft	time
tonnage	mesh
gold content	handling
silver content	hydraulic
copper	mechanical
form	manual
manganese	
form	<b>SLIME</b>
pyrolusite	thickening
other metals	tonnage
<b>BREAKING</b>	time
gyratory	agitation
Blake	mechanical
Dodge	pump
sorting	air
sampling	charge
elevation	series
<b>CRUSHING</b>	washing
grizzly	decantation
trommel	filtration
in water	vacuum
in solution	site type
dry	pressure
feeders	patents
ore	<b>PRECIPITATION</b>
lime	clarification
rolls	filter press
Huntington	tank
stamps	zinc
gravity	shavings
steam	dust
ball mill	press
chilean mill	patents
<b>AMALGAMATION</b>	reduction
inside	roast
outside	acid
after chilean	niter cake
after tube	melting
of concentrate	coke
retorting	oil
<b>CLASSIFICATION</b>	<b>MISCELLANEOUS</b>
screen	mechanical
drag	sectional
wheel	power
hydraulic	steam
<b>CONCENTRATION</b>	electrical
table	water
vanner	gas
value	lighting
copper	heating
form	pump
free gold	spiral
free silver	centrifugal
<b>GRINDING</b>	plunger
tube mill	vacuum
silex	compressor
ribbed	tankage
chilean	steel
pan	wood
<b>INCIDENTALS</b>	concrete
drawings	machine shop
freight	foundry
duties	transmission
insurance	pipng
	spare parts
	tools

Plant Designer," but it is expected to be of assistance to others than experts, who have to obtain or make estimates.

The general nature of the ore, its condition and tonnage, influence the class and size of crushers, as well as the arrangements for screening, sorting and conveying. The content and form of contained copper indicate concentration or its omission, and also, like manganese may prevent the use of the process.

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## GYRATORY BREAKER FOR LARGE PLANTS

Under "breaking" is indicated the choice of the type of breaker, and this is largely governed by the capacity desired, the Blake and Dodge being suitable more especially for the smaller plants, the gyratory being preferred where it is desired to feed the ore in carloads. This statement cannot be made without some qualification, since, for example, Blake breakers are made with 5-ft. openings. Sorting and sampling are not ordinarily provided for small plants, but are usually required for large ones and for custom plants of any size.

Whether crushing is to be done in water or solution influences various items, such as tankage, pumps, motors, power, settlers, precipitation, etc., throughout the plant. Dry crushing usually involves driers or roasting furnaces, besides special small details such as feeders.

The type of crusher, whether rolls, ball mill, stamps or chilean mill, depends on other parts of the process, such as amalgamation, concentration and leaching, and should not be decided upon prior to laboratory tests. The decision as to where the amalgamation is to be done (if at all) influences such things as stamp-mortar form, screen mesh (and therefore stamp capacity), concentrate treatment and value and the refinery equipment.

## METALLURGICAL FEATURES DEPENDENT UPON TESTS

Classification, including the grizzly, is governed by arrangements for concentration, amalgamation, grinding (tube mill, pans or chilean mills), and by whether sand treatment or all-slimes is best. Plant arrangement for concentration is dependent entirely upon results of test, as, of course, are all of the metallurgical features as distinguished from the mechanical. Grinding can be done with several machines of distinct types, the choice falling usually on the tube mill with ribbed-iron lining.

When sand leaching is decided upon, the choice of mechanism for classification, separation, collection and handling, in and out of the leaching tanks, as well as the size and number of tanks, is guided largely by local conditions covering plant site, capacity, water supply and labor costs. Slime thickening can be continuous or intermittent, and agitation can follow either of a variety of systems, either air or mechanical. The tankage for slime treatment depends on tonnage, consistency and method and time of treatment.

## MANY SCHEMES FOR WASHING SLIMES

The only method of separating valuable solution from sand is by percolation (though water is now separated by means of vacuum filters) but the schemes for slime washing are numberless. Plain

agitation and decantation involve greater tankage and precipitation area than vacuum filtration, which requires least. Other methods, including continuous settlement and wash, and continuous decantation and treatment, require somewhat more tank capacity than filtration, but have advantages in some cases.

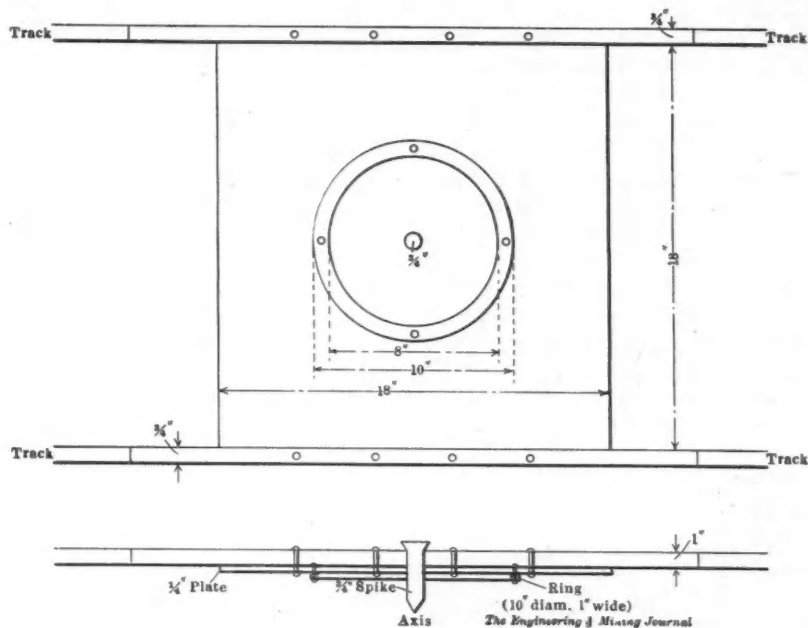
Precipitation is a problem which is usually solved by adhering to the standard zinc-shaving method. However, zinc dust in skilled hands is making its way slowly but surely and should not be left unconsidered in designing. Slight variations in methods of reduction of precipitate are numerous, but have little to choose between them except in connection with cost of fuel, labor and the prevention of theft.

Under the heading "mechanical" must

## Turntable for Mine Cars

A turntable similar to that described by Fred T. Williams in the JOURNAL of Feb. 19, but having the advantage of being of simpler construction and requiring no bed other than an ordinary tie is shown in the accompanying drawing. In place of switches or iron plates such small turntables are used at tunnel crossings, in the Highland Boy mine of the Utah Consolidated, Bingham cañon. The turntables act quickly, are easy and cheap to build and keep in repair, and save space at the tunnel junctions.

A piece of  $\frac{1}{4}$ -in. iron plate is riveted to two  $\frac{3}{4}$ x1-in. iron strips placed with the larger dimension vertical and spaced the same as the tracks, a continuation of which they form. A hole for a  $\frac{3}{4}$ -in.



TURNTABLE USED IN HIGHLAND BOY MINE

be considered things which can hardly be mentioned here, much less discussed. The one item of "machine shop" should be the first considered, except where the plant is to be within reach of other shops. Such items as "piping" are not the least important, as they include the selection of light, riveted pipe for slime transfer, all-iron and quick-opening valves for solutions, and the placing of numerous and convenient unions in addition to the steam and heating piping.

It is seldom that a stope can be utilized as an ore pocket. This, however, is the case in the Florence mine at Goldfield. The orebody intersects the shaft so that it was only necessary to crosscut 4 ft. to make a connection from the shaft to the stope. Ore broken in the stope is drawn directly from it into the skip, all tramming thus being eliminated at this point in the mine.

spike is punched in the center of the  $\frac{1}{4}$ -in. plate and on its under side about the center point a ring of  $\frac{1}{4}$ x1-in. iron 10 in. in diameter, is riveted. This completes the turntable.

A tie slightly over 10 in. wide is laid at the point about which the turntable must pivot and to this it is spiked. The spike acts as the pivot and the ring on the underside of the  $\frac{1}{4}$ -in. plate serves as a bearing on the surface of the tie. A plentiful supply of grease is provided at this point to keep the table turning easily. There is practically no opportunity for dirt to get on this bearing surface, so little attention is required for the device.

In 1909, at the Ready Bullion mine, Alaska, 268,904 ft. of machine-drill holes broke 315,941 tons of rock, an average of 1.17 tons per foot of hole. The 700-Foot Claim mine broke 261,737 tons with 263,804 ft. of holes, an average of 0.99 ton per foot.

# Report of the Tennessee Copper Company

The annual report of the Tennessee Copper Company states that no effort was made during 1909 to increase the copper output owing to its low price and to the lack of sufficient facilities for utilizing the sulphur contents of additional tonnage. Ore reserves, however, were increased to over 600,000 tons above those at the end of the previous year.

The increased demand for sulphuric acid in the vicinity of the plant, led the board of directors to authorize the issue and sale of \$600,000 par value three-year 6 per cent. notes to construct an addition to the acid plant which will more than double its output. Final connections to this addition are now being made so that within a short time the volume of fumes discharged into the atmosphere will be effectually reduced, eliminating all difficulties from this source in the future.

It is proposed to make the large holdings of barren land that the company controls, yield a revenue. To this end some experiments in farming are being carried on to prove that the smoke has been rendered innocuous by its passage through the acid plant. Through the economies effected by the installation of the acid plant, the ore reserves can be valued now at a little more than twice the former net profit per ton.

In line with the progressive policy of the company, great progress was made during the year in changing over from the older ways of mining to a modified "back stoping" system. By this change they expect to secure safer working for the men, cheaper mining and a larger percentage recovery of the measured ore.

Development was greatly curtailed owing to the inadequate supply of labor at the mines. Despite the company's best efforts, the daily average number of men obtainable at the mines last year was fifty less than in 1908. Efforts to solve this problem have been made in the organization of a special department, the function of which will be to make the camp more attractive to the men and their families. A club house for staff members at Copperhill has been built; a large Y. M. C. A. building for the men, a staff house at the mines, athletic fields, etc., are all in a flourishing state of development.

## MINE DEVELOPMENT

During the year 4765 ft. of diamond drilling was done and a total of 3725 ft. of development work was accomplished.

In the Polk County mine the 385-ft. level was completed and ore was blocked out and stoping begun. This was the first new level in this mine since 1902. As diamond drilling indicated the continuation of ore below this level, work was

started on a new lift of 100 ft. of which 46 ft. were finished.

The main shaft of the Burra Burra mine was completed to the seventh level and crosscutting and drifting commenced. A great deal of delay was caused by loose ground encountered just below the sixth level. The shaft, however, is now well timbered. The McPherson shaft was sunk 113 ft. during the year and is being carried down to the sixth level where drift-

## ASSETS.

Mining property and other real estate, original cost	\$3,407,400.00
Expended for development previous to July 1, 1901	204,567.89
Discount on bonds and other securities issued	62,750.00
Mine equipment	200,356.91
Railroad and equipment	283,409.88
Smelter construction	1,144,104.49
Sulphuric plant:	
First unit	798,970.98
Second unit	370,441.35
Quarry equipment and buildings	329,027.54
Stock on hand	326,083.57
Copper inventory (at selling prices of unexecuted orders)	435,153.02
Sulphuric acid inventory (at selling prices of unexecuted orders)	15,700.00
Accounts receivable	219,953.07
Cash in banks and on hand	518,811.65
	\$8,316,730.35

## LIABILITIES.

Capital stock, 200,000 shares, par value of \$25 each	\$5,000,000.00
First mortgage 5% bonds, due July 1, 1922	350,000.00
Three-year 6 per cent. notes, due Aug. 1, 1912	600,000.00
Accounts payable	465,628.11
Sulphuric acid account	269,276.03
Reserves—profit and loss	\$1,263,792.21
	\$8,316,730.35

ing to meet the level from the main shaft will be started. A system of back stopes has been started on the sixth level of this mine, which give better protection to the men and are expected to cheapen both the cost of breaking the ore and of tramming.

The burning of the crusher house and shaft of the London mine curtailed production from this source, although new ore was opened on all levels but the first and some important development work carried on in the fifth level north. During 1910, the shaft will be sunk another lift.

Surface mining in open cut was started in the Eureka mine in November, 1909. Surface grading has been done for the installation of a plant, and a three-compartment vertical shaft started. The shaft is being equipped with hoisting apparatus, air compressor and crushing plant. It is expected to make a producing mine of the Eureka during 1910. The copper contents are lower than Burra Burra but with present developments of acid manufacture, the value of the Eureka ore per ton is about one and one-half times the value of a ton of Burra Burra, as computed three years ago.

The production of ore in tons from the different mines was as follows: Polk

County, 93,208; Burra Burra, 264,939; London, 81,952; and Eureka, 1807; making a total of 441,906 tons.

## SMELTING AND CONVERTING

The operations of the smeltery continued to show improvement, the percentage recovery exceeding that of 1908 by 2.7 per cent. On account of the custom-ore business it was found necessary to construct a sampling works at the smeltery, the cost being charged to operating expense. A sintering plant installed late in the year is making the flue dust yield its copper at a small cost.

The material in tons handled in the smelting and converting operations for the year consisted of: Tennessee sulphide ore, 439,365; custom ore, 20,438 converter slag, 4592; blast-furnace slag, 28,358; sintered flue dust, 2209; quartz flux, 90,087; limestone, 22,984; clay, 2193; first matte, 111,539; making a total of 721,765 tons. The amount of coke charged was 40,210 tons.

Furnace No. 5 has been completely torn down and is being erected on new lines. This change is being made for the benefit of the acid plant and if found

## PROFIT AND LOSS.

DEC. 31, 1909.

<i>Dr.</i>	
To interest on bonds	\$18,750
To accrued interest in 6 per cent. gold notes	15,000
To bond and note issue discount	29,500
To depreciation	25,000
To profit for year	339,405
	\$427,655
To dividend No 9	\$250,000
To general reserve	75,000
To balance of profit	1,263,792
	\$1,588,792
<i>Cr.</i>	
By interest and discount	\$5,393
By royalties, custom ore and merchandise department	43,413
By copper production	296,017
By sulphuric-acid production	82,831
	\$427,655
By balance of profit for 1908	\$1,249,386
By net profit for 1909	339,405
	\$1,588,792

satisfactory, other furnaces will be remodeled along the same lines.

The cost at the smeltery as compared with the previous year is greater per ton of ore, but less per pound of copper, proving that the added expense has been more than compensated for by the better extraction obtained. The cost of converting copper from matte to pig has been reduced materially by the use of custom ore and on account of the increased amount of copper converted.

## SULPHURIC ACID PLANT

In the first unit of the acid plant, some expensive changes were made at the beginning of 1909, but the work has

proved to be what was needed. Experimenting continued throughout the year, resulting in changes that have increased the efficiency of the plant. In December the make of acid was about double the production of any month of 1908. This unit yielded a profit of \$82,831 during the year under review.

With the completion of the second unit, the plant will have a greatly increased capacity and as the experience with the old plant has been carefully recorded, many improvements have been incorporated in the new plant.

The acid plant is also to receive the benefit of a more regular and steady flow of gas to the chambers through the introduction of the bedding system for the smelting charge.

The labor distribution for the year averaged as follows: Mines, 528; smeltery, 426; acid plant, 42; railway, 52;

construction, 155; and miscellaneous, 120; making a total of 1323 men.

In the transportation department, 56 tons of new 80-lb. rails were laid, in many places where 65-lb. rails were wearing out. A steel car of 100,000 lb. capacity was added to the equipment.

COPPER PRODUCTION AND COSTS

The total ore smelted for the year from the mines of the company was 439,365 tons, producing 14,058,954 lb. copper at an extraction of 32 lb. per ton. Based on these amounts, the accompanying table gives the detailed operating costs for delivering copper f.o.b. cars, at Copperhill, Tenn. In addition to this, 2,415,734 lb. copper were produced from custom ore smelted on toll and 101,995 lb. from ore purchased. Of the total amount, 4,095,848 lb. were electrolytically refined; the remainder was prepared for

market in the form of pig copper. There were recovered 24,753 oz. silver and 117 oz. gold.

DETAILED COSTS OF FINE COPPER IN FIG.

Item.	Cost per Ton.	Cost per Lb. Copper, 1909.
Mine development.....	\$0.12201	\$0.00381
Mining ore.....	1.09724	0.03428
Smelting.....	1.31109	0.04098
Converting.....	0.14691	0.00459
Railway.....	0.05841	0.00183
Engineering and laboratory.....	0.03831	0.00120
General expense.....	0.15478	0.00484
Copperhill costs in 1909.....	\$2.92875	\$0.09153
Copperhill costs in 1908.....	.....	0.0928

The total cost of copper, after adding freights, commission, taxes, legal expenses, administration, and all other expenses, was 10.68c. The cost of electrolytic copper, after allowing for silver and gold, was 11.19 cents.

## Safety in Mines and in Mills

The following notice has been posted at various places on the property of the Goldfield Consolidated Mines Company:

"The company desires to adopt all reasonable and practical precautions to insure the safety of its employees from accident. All men are invited to send in any suggestions that may occur to them with regard to anything that may be done to make safer any machinery or equipment of any kind in any part of the property to Heath Steele, chief of the inspection department, at the Combination office. Such suggestions will be gladly received and carefully considered.

GOLDFIELD CONSOLIDATED MINES Co.  
J. R. FINLAY, General Manager."

While the meaning of this notice is obvious, it may be interesting to state some of the circumstances that have led to it, says the *Goldfield Daily Tribune*. It is simply part of an effort that is being made by mine operators and mining engineers in this country to diminish the loss of life in mines and metallurgical works.

Mr. Finlay has been for more than three years a member of a committee, appointed by the American Mining Congress to recommend to the various States a mining law that could be adopted generally and that, if properly enforced, would diminish the danger of injury and impairment of health to men working in mines. The other members of this committee are as follows: W. R. Ingalls, chairman; J. Parke Channing, Dr. James Douglas, and John Hays Hammond.

This committee will soon make its formal report. It has prepared several drafts of a proposed law and has invited suggestions and criticisms from every available source. It has secured from

lawyers advice as to the legal phrasing and constitutionality of the provisions it proposes to recommend. In short, the committee has worked with a sincere desire to present a report that would do some good.

PROGRAM OF CONSOLIDATED

The program of the inspection department of the Goldfield Consolidated is based on general principles and has no reference whatever to anything particularly dangerous about the company's property. On the contrary the mines of Goldfield are remarkably safe and healthful. The stopes are well timbered, the ventilation is excellent, and there is much less dust and much less water than is usual in mines of the same class. The company is merely trying to be as systematic and businesslike as possible in this matter. If the natural conditions are good, so much the better, and the company is anxious that its employees should get the full benefit of them.

It is to be remembered that the dangers of mining are not confined to sudden accidents. The insidious undermining of health through breathing dust from machine drills, vitiated air, poisonous gases from explosives and from the rocks, exposure to water, etc., is of far more real importance than deaths and broken limbs from falls of ground or the various more obvious dangers that the men must encounter. A gray-haired mining engineer, who had watched the development of mining in the West for 40 years, remarked while looking at a group of miners coming off shift in the Cœur d'Alenes:

"Look at those young men! They are all young! I wonder what becomes of

the old men about the mines? When I was on the Comstock in the early days the men were all young. The mines get old, but the men in them remain young. They are new men. They don't get old in the mines. Either they die off or they can't stand the work after a few years of it. It is one of the saddest sights I know of."

PROTECTION AGAINST DISEASE AND FIRE

The Goldfield Consolidated has no intention of applying any maudlin sentiment to the treatment of its employees—merely common sense. Good business is efficient business and the company wants good work. It wants as good work in the way of protecting its men from unnecessary injury and disease as in any other direction.

The inspection department is working to this end. During the last few weeks the surface drainage and sewerage systems have been improved, and with the work planned will provide for the disposal of all waste water and refuse in a sanitary manner. Antiseptics are used in all drains, pits and places where gases are liable to arise. As fast as possible, the general appearance of the surface is being improved. Old buildings are being removed, scrap material, etc., is being hauled to an out-of-the-way place and provisions made to prevent such material from accumulating around the property.

A high-pressure water system for fire-fighting purposes, has been planned and is now under construction. A reservoir situated on top of Columbia mountain has been started and pipe-line trenches through solid rock are now about completed down to the foot of the mountain. Material has been ordered to install this

system, including pipe, high-pressure pumps, hydrants, hose and a full equipment to insure complete protection against fire.

The properties are divided into fire divisions, each of which will have a fire house, with its own equipment. Each division will have its own captain and fire organization which will be thoroughly drilled and ready at all times to respond to an alarm. Each of these divisions has been supplied with a 40-gallon Badger chemical engine. These, together with the hand extinguishers, will

afford ample protection against small

Fire helmets for use underground in case of fire, have been ordered and upon arrival of these helmets men will be trained to use them so as to be able to protect both life and property underground.

A regular inspection of hoists, cages, shaft and ropes is now practised. This, together with the coöperation of efficient engineers and cage tenders, will insure good protection to men from accident while being lowered or hoisted from mines.

A close watch is being kept on all ladderways, main passage ways, in all parts of the mine to insure perfect safety.

All surface plants and machinery are being inspected and wherever improvements can be made to guard against accidents they are being made.

One line of work, in particular, that the inspection department intends to take up will be to investigate the causes of disease peculiar to underground workers, and, if possible, to take steps to eliminate the cause, if such is found in the mines of the Consolidated.

## The History of the Rock Drill

BY W. L. SAUNDERS\*

The rock drill is an American invention conceived and developed in the United States. J. J. Couch, of Philadelphia, took out the first practical patents in 1849. In his experiments he was assisted by Joseph W. Fowle. The Couch drill was a crank-and-flywheel machine.

### COUCH AND FOWLE PRECEDED BURLEIGH

Couch and Fowle separated in 1849, the latter filing a *caveat* in 1849 covering a drill of his own invention and describing the successful power rock drill substantially as it is today. The most important feature of Fowle's drill is that the cutting tool was attached directly to the piston. Fowle described this invention before the Massachusetts Legislative Committee in his contest with Burleigh in 1874, as follows:

"My first idea of ever driving a rock drill by direct action came about in this way: I was sitting in my office one day after my business had failed and happening to take up an old steam cylinder, I unconsciously put it to my mouth and blew the rod in and out, using it to drive in some tacks with which a few circulars were fastened to the walls."

Abroad, the nearest approach to rock-drill invention was the work of Mr. Schumann, carried on in 1854. Fowle being without means to develop his ideas, they remained in obscurity until Charles Burleigh, about 1866, purchased his patents and produced the Burleigh drill. This drill was used in driving the Hoosac tunnel in Massachusetts in 1867.

Following Couch, Fowle and Burleigh came Haupt, Wood, Ingersoll, Sergeant, Waring and Githens. Githens was the inventor of the Rand drill.

\*President, Ingersoll-Rand Company, New York.

The Ingersoll drill was invented in 1871. Simon Ingersoll, a modest, ingenious and honest mechanic, came to New York from Connecticut, bringing with him the models of several inventions. He was riding in a New York horse car one day and was describing one of his inventions to a fellow passenger. Another passenger in the car was John D. Miner, who overheard Ingersoll's conversation. Miner was a contractor, engaged with a gang of men on some rock excavation in New York.

Miner broke into the conversation to ask Ingersoll why he didn't invent a rock drill, telling him that he had a gang of men at work striking a steel with a hammer to make a hole for blasting; that they could put in only about 10 ft. of hole per day; and that he did not see why a machine could not be built that would do the work.

Ingersoll said he could make such a machine and would go at it at once if he had the money. Miner gave him \$50 and his card, saying that though he had never seen Ingersoll before, he had an honest face and he would trust him to spend that \$50 in building a rock drill. "When you want any more," said Miner, "come to me and I'll give you another fifty." Ingersoll's first rock drill was built in a shop at Second avenue and Twenty-second street, New York, owned by J. F. de Navarro, and was managed by Sergeant & Cullingworth.

### SERGEANT'S IMPROVEMENT

One day Henry C. Sergeant saw the patterns for Ingersoll's drill. He noticed that the front head was attached to, and was a part of the cylinder. He told the workmen that they should be in two pieces and proceeded to saw off the pattern. At this point Ingersoll came in the shop. "What are you doing?" he asked. "I'm making this thing practical," said Sergeant, as he finished cut-

ting off the pattern before Ingersoll could stop him. The result was the first row between Ingersoll and Sergeant, and it led later to Mr. Navarro purchasing, on Sergeant's advice, all rights and patents held by Ingersoll. The Ingersoll drill was made with the separate front head, as used today.

### ORGANIZATION OF THE INGERSOLL COMPANY

Mr. Navarro organized the Ingersoll Rock Drill Company, investing \$10,000 in the concern. Litigation arose with Burleigh, of Massachusetts, who owned the rights of Fowle and others. However, Mr. Navarro's plentiful supply of funds and his liberal nature, brought about a settlement on the suits, and all the patents became the property of the Ingersoll Rock Drill Company.

The business quickly paid back to Mr. Navarro the \$10,000 he had put into it, and in later years he sold his interests to R. W. Chapin for \$525,000. Sergeant sold out because of friction with the management, went West, engaged in mining, returned to New York about 1885 and organized the Sergeant Drill Company.

### THE RAND DRILL COMPANY

Early in rock-drill developments the Rand brothers, Addison C. and Jasper R., had become interested through their connection with the Laffin & Rand Powder Company. Addison C. Rand formed the Rand & Waring Drill and Compressor Company, later controlled exclusively by Rand and merged with the Rand Drill Company, established in 1871 and incorporated in 1879.

J. C. Githens, superintendent of the Rand Drill Company, invented the "Little Giant" rock drill. He was the originator also of many improvements, notably the double-screw column with

column arm, which made practical the application of the rock drill to mining and tunneling.

#### CONSOLIDATION OF ORIGINAL COMPANIES

The Sergeant & Cullingworth Company, manufacturing the Ingersoll drill, the Sergeant Drill Company, and the Ingersoll Rock Drill Company were merged into the Ingersoll-Sergeant Drill Company. Later on, the Rand Drill Company and the Ingersoll-Sergeant Drill Company were consolidated into the Ingersoll-Rand Company, today carrying on the business of all these pioneer concerns. The Rand drill from the beginning had been the most formidable competitor of the Ingersoll and Sergeant types. The conjunction of the Ingersoll-Sergeant and Rand companies, therefore, was a combination of valuable patents in rock drills, compressors and general machinery for mining, tunneling and quarrying. Each shop received the benefit of the experience of all the others and the best features of the Ingersoll, Sergeant and Rand types were taken to make up an improved product.

#### West Virginia Geological Survey

The West Virginia Geological Survey, Morgantown, W. Va., has just issued two new publications: A new edition of the coal, oil, gas and limestone map; and a new detailed county report on Pleasants, Wood and Ritchie counties.

The new edition of the map contains a thorough revision of the coal, oil and gas developments, the same being brought uptodate as nearly as possible. It also contains the railway lines, constructed since 1908. The names and post-office addresses of all the coal companies operating in West Virginia up to the early part of 1910 are given on the map by counties, and the situation of the several mines is indicated by appropriate symbols and numbers. This map can be obtained for 50c. by application to the survey office.

The detailed county report, containing topographic, geologic and soil maps, is complete for the district covered. The soils have been studied, mapped and described by the U. S. Department of Agriculture. The topographic map shows the geology, all the roads and by-roads, houses, villages, etc. The oil and gas pools developed up to 1909 are shown by appropriate symbols. This book may be obtained for \$1.75 by addressing the survey office.

A cement plant will be erected at Juarez in Mexico opposite El Paso, Tex., with a capacity of 2000 bbl. daily. During 1909 12,000,000 bbl. of cement were imported into Mexico principally from England.

#### The Mining Industry in Guatemala

The mining industry of Guatemala is beginning to occupy a prominent place, due largely to railway construction and the exploitation of mines by foreign capital.

##### EARLY OPERATIONS

Mining operations date back to 1627 and were carried on either directly or indirectly by the church. When theocratic supremacy gave place to democratic rule, the mines were abandoned and forgotten, only faint traditions of the richest ones having been handed down from generation to generation. In 1866 an English company was organized and conducted operations on the San Pantaleon vein, and is reported to have made good profit for 20 years.

In the Huehuetenango district, on the south slope of the Chuchumantanes mountains, rich silver-lead deposits have been discovered; also iron and copper in sufficient quantity to justify careful exploration. The silver-lead mines of this district were worked by the natives in a desultory fashion during the last century for the sake of lead alone.

The Chiquimula district, which is penetrated by the Guatemala railway, is said to contain diversified mineral deposits, in which gold, silver, copper, zinc, iron and manganese exist in such quantities as to make profitable the proper working of these deposits. This district in former days produced large quantities of silver, but the mines caved and have never been formally opened since. These mines are in the Alotepeque mountains.

The departments of San Marcos, Quezaltenango, Solola, Chimaltenango, Sacatepequez, Amatitlan, Santa Rosa, Jalapa, Jutiapa, and Guatemala all contributed to the mineral exhibits of the National Exposition numerous samples of their metallic resources, and are worthy of careful examination by anyone desiring mining properties.

##### GOVERNMENT REGULATIONS

The Guatemalan government recognizes the extreme importance of developing and fostering the mining industry, and to this end a mining code was enacted in 1909, which provides that any one may denounce mines of any class and obtain possession by following the procedure as set forth in the code, with the exception of deposits of sulphur and saltpeter. These may be worked through special contract with the national government. No permit is necessary to prospect gold-bearing sands of the numerous rivers, and placers open to the public may be freely utilized. Should any one desire to work such deposits as a

\*Abstract of report of Consul-General of Guatemala.

permanent establishment by means of machinery or construct works, he must solicit the concession of a mining claim. Anyone, on the other hand, may exploit deposits on uncultivated land with the obligation to pay any damages, and also on cultivated lands after notifying the owner or his representative, and should the owner object, appeal should be made to the authorities for the desired right.

#### The Government Testing Plant

Important action taken on June 25 by the conferees of the House and Senate with reference to the sundry civil appropriation bill has resulted in materially modifying the work of the Bureau of Mines and the Bureau of Standards, at the same time altering the Bureau of Mines act by apparently repealing part of its provisions. The original bill transferred to the new bureau the work of testing structural materials which has been done by the Geological Survey and entrusted the Bureau of Mines with the machinery for testing materials which has been bought and installed. When the sundry civil bill was originally introduced it contained a provision of \$100,000 for the work of testing structural materials during the coming year, such work to be done by the Bureau of Mines. This provision was altered on various occasions during the discussion, the effort being to transfer the work of testing to the Bureau of Standards and to give that bureau \$50,000 instead of the original \$100,000 for doing the work. The bill when returned from conference committee to the House carried this change and the alteration led to a considerable debate. This controversy was shared in largely by Pennsylvania representatives who urged on behalf of the city of Pittsburg that the work of testing be continued there as heretofore.

Representative Tawney, chairman of the House Appropriations committee, argued that the demand of the Pennsylvanians for the continuance of the work was due to a desire on the part of some Pittsburg corporations to get their testing done without charge. When the bill finally came back to the House it still kept the change whereby the appropriation for testing in the Bureau of Mines was omitted and the other change whereby \$50,000 for testing was given to the Bureau of Standards.

Contradictory opinions are entertained with reference to the effect produced by this provision, in view of the fact that the Bureau of Mines act gives the work to that organization. These conflicting views were represented in the exchange of views at the close of the debate in the House, but the general opinion was that the transfer of the appropriation repealed the former provision and effected the transfer of the plant to the Bureau of Standards.

# Cost of Metallurgical Works

BY W. R. INGALLS

In any estimate of cost of production, the necessary investment in plant is an essential consideration. In generalizing the following data as to the cost of some typical plants, it is important to make allowances for differences in time; i.e., the data do not refer to the same period, and a plant which may have cost a certain amount of money at a certain time might five years later cost materially more, owing to an increase in the cost of labor and material. For purposes of comparison, and also for other purposes, it is useful to reduce figures to the basis of the ton of annual capacity.

## CONCENTRATING MILLS

The cheapest type of mill is that which is used in the Joplin district. A few years ago, such a mill of 50,000 tons annual capacity could be built for \$6000 to \$8000, or 12 to 16c. per ton of capacity. The cost at the present time is perhaps not materially higher. A mill of different type, designed for the concentration of mixed sulphide ore, requiring fine grinding, can be built on certain lines for \$10,000 to \$12,000 for 15,000 tons capacity, or 67 to 80c. per ton, but mills for the same purpose, of different design, may cost materially more. In this connection it is important to remark that cheapness in first cost may be at the expense of cheapness in subsequent operations, and *vice versa*. The same principle governs all kinds of metallurgical work.

Passing to larger mills, one of capacity of 75,000 tons per annum, built of timber in the old-fashioned way, like many of the mills in the Cœur d'Alene, cost about 60c. per ton for construction, in Missouri, 10 years ago. The mill of the St. Louis Smelting and Refining Company, a steel construction, built at about the same time, cost about 80c. per ton for 300,000 tons capacity. Under present conditions the figures would doubtless be considerably increased. The Silver Lake mill, Animas district, San Juan county, Colo., 75,000 tons capacity, cost \$1.33 per ton.

The mill of the Boston Consolidated, near Salt Lake City, 1,000,000 tons, cost about \$1.50 per ton. The Garfield mill of the Utah Copper Company, which may be rated at 2,200,000 tons, up to Dec. 31, 1909, had cost \$4,097,593, which is \$1.85 per ton of capacity. The difference between the cost of these two mills is partly explained by the fact that the Boston mill has no power plant, except its transforming station, electric power being purchased. The Utah and

Boston mills were both constructed at a period (1907) of high cost for material and labor. They are both designed for fine grinding, which, of course, increases the cost of a concentrating mill. Finally, both of them are provided with large ore-storage capacity, which is always costly. Overhead storage bins can seldom be built for less than \$3 per ton of capacity, and the cost may run up to \$5 or more.

Up to March 31, 1910, the mill of the Ohio Copper Company, at Lark, Utah, 1,000,000 tons capacity, had cost \$1,273,215. It is estimated that \$250,000 is required to complete the plant. According to these figures the cost of the plant will be about \$1.50 per ton of annual capacity.

## MAGNETIC SEPARATING PLANTS

Concentrating plants that are to employ the process of magnetic separation are far more costly than simple mills. The works of the New Jersey Zinc Company, at Franklin Furnace, N. J., somewhat upward of 300,000 tons capacity, cost about \$1.75 per ton. Small plants of 15,000 tons capacity, employing fine grinding, Wilfley tables and Wetherill separators, may be expected to cost from \$3 to \$4 per ton, depending somewhat upon whether roasting furnaces must be provided.

## COPPER SMELTING WORKS

A blast-furnace plant employing the semipyrritic process, where no roasting furnaces were required, cost \$600,000 in 1901 for 330,000 tons capacity, or about \$1.70 per ton. The Balaklala works, in Shasta county, Cal., estimated to have 437,500 tons capacity, constructed in 1907-8, when labor and material were dear, cost a little less than \$2.25 per ton, of which 25c. was for the converter plant. This works has Macdougall roasting furnaces, blast furnaces and a reverberatory furnace for smelting flue dust and other fine producers.

The Washoe works, at Anaconda, Mont., having an annual capacity of 3,000,000 tons, has cost \$10,753,013 up to date, according to the books of the company, but that figure includes the cost of plant that has been discarded and amortized. This works, moreover, comprises a concentrating mill which greatly reduces the bulk of the ore passed on to the smeltery proper. The total book-cost of the Highland Boy works, near Salt Lake City, a plant of 300,000 tons capacity, was \$972,676. The Garfield works, a plant similar to the

Washoe but without the concentrating mill, near Salt Lake City, 800,000 tons capacity, cost \$6,000,000, or \$7.50 per ton. This was notoriously an extravagant construction, but it is to be remarked that its design is such that its capacity can be largely increased without proportionate increase in first cost. This is another condition that is to be reckoned in attempting generalizations of this kind.

## LEAD SMELTERIES AND REFINERIES

A modern lead-smelting works, of 330,000 tons annual capacity, costs from \$800,000 to \$1,000,000, or \$2.30 to \$3 per ton. The lower figure ought to be approximated rather than the higher. A lead-desilverizing refinery, capable of treating 30,000 tons of base bullion per annum, costs about \$6.66. An electrolytic lead-refining plant is more costly.

## ZINC SMELTING WORKS

In zinc smelteries there is a wide range. Works of 25,000 tons annual capacity in the natural-gas field of Kansas and Oklahoma have been built for as little as \$7 per ton, but there have been usually additions to make and I am disposed to put \$8 per ton as the minimum for a plant with full roasting capacity. A plant in the same field, of superior design and construction, cost about \$10 per ton. These figures represent conditions of 1901-5. At the present time they might have to be increased by 10@12½ per cent. One of the recent plants of the ordinary type cost about \$9 per ton.

A plant to burn coal, with gas producers and regenerative furnaces, in Europe a few years ago was figured to cost about \$15. The same plant in the United States would probably cost \$17.50 @18, but actual constructions have run as high as \$20, in which cases there have been careless mistakes and extravagances. A plant of equally high efficiency, but designed on more rational lines, could probably have been built for \$16. However, under present conditions it is likely that all of these figures would have to be increased.

## SULPHURIC ACID WORKS

If a sulphuric-acid works is to be added to the zinc smeltery, the cost will be \$5@6 per ton, based on pig lead at 4c. per lb. The figures do not, of course, include cost of burners, the place of which is supplied by the roasting furnaces. Such a plant is reckoned as being capable of producing acid of 60 deg. Baumé.

# Electrostatic Separation of Minerals in Ores

Utilization of the Variations in the Conductivity and Inductivity of Minerals. Huff Machine Used in Wisconsin and Utah on Zinc Middlings

BY HENRY A. WENTWORTH\*

The art of separation of the minerals present in ores by utilizing their differences in electrical conductivity and inductivity in an electrostatic field, is now several years old, as reckoned from its conception, but only little more than two years old, as computed from the time of its permanent commercial success on a large scale. For several years prior to 1908, electrostatic separation had been experimented with to solve various "complex-ore" problems, and its principles and proposed usage at that stage of its development have been set forth and described in the JOURNAL and other technical publications.

The electrostatic separator, as used today, and the several special types of electrical apparatus which it was found necessary to develop for the proper elec-

without roasting, the jig products from the various wet mills of the Wisconsin zinc district. It is producing daily, about 80 tons of concentrates from a supply of blende and marcasite, averaging in composition approximately 25 per cent. zinc and 25 per cent. iron (the remainder being sulphur and a little gangue). One concentrate product ranges in composition from 55 to 60 per cent. zinc, and 2.5 to 3.5 per cent. iron, and another product of high-grade marcasite (valuable from its high sulphur content for sulphuric acid) assays from 4 to 4.5 per cent. zinc.

## SUCCESSFUL OPERATION AT MIDVALE, UTAH

The success of the Platteville plant concentration and separation, the electrostatic art has become an addition of great

copper and iron of the feed, which product is smelted in the lead furnaces.

In regard to this plant, the United States Smelting, Refining and Mining Company says in its annual report recently issued for the year 1909, "The value of the ore was considerably enhanced by the installation, in the concentrator at Midvale, Utah, of the Huff electrostatic process of separation. By this process the zinc contained in the ore is separated and is now made to yield a revenue.

Before the installation of this process, the zinc was not only a total loss, but it added, on account of its refractory nature, materially to the difficulty and cost of smelting." In other branches of ore concentration and separation, the electro-



AMERICAN PLANT AT PLATTEVILLE, WIS., USING ELECTROSTATIC SEPARATORS



UNITED STATES SMELTING COMPANY'S CONCENTRATOR AT MIDVALE, UTAH

trification of the separator for commercial field work, are the result of gradual development for many years. Ever since the disclosure of the principle, the development, as represented by the present types of Huff separators has been carried on by, and under the direction of Charles H. Huff, of Boston, Mass.

## FIRST INSTALLATION AT PLATTEVILLE, WISCONSIN

The first Huff electrostatic separator, of type D for zinc separation, was put in operation in March, 1908, at Platteville, Wis., where in that month was completed and started an electrostatic separating plant for the American Zinc, Lead and Smelting Company. A view of the plant, as it stands today, is shown in an accompanying illustration. This plant has been in practically continuous operation since its completion, treating,

\*Manager, Huff Electrostatic Separator Company, 60 India street, Boston, Mass.

static art, both in this and foreign countries, as has also the success of the electrostatic separating plant of the United States Smelting, Refining and Mining Company, at Bingham Junction (now called Midvale), Utah. A view of this plant is also shown in an accompanying illustration. At Midvale, the crude-ore feed to the wet concentrator analyzes: Au, 0.08 oz.; Ag, 3.8; Cu, 0.41 per cent.; Pb, 8.4; SiO<sub>2</sub>, 28.8; Fe, 14.3; Zn, 9; S, 21.6; CaO, 6 per cent. A shipping lead product, a tailings, and a middlings are produced, the latter assaying Au, 0.05 oz.; Ag, 2.8; Cu, 1.11 per cent.; Pb, 3.3; SiO<sub>2</sub>, 4.6; Fe, 24.3; Zn, 21.6; CaO, 1.9. This product is passed into the electrostatic mill, dried but not roasted and separated electrostatically, producing a high-grade blende of the following approximate composition: Au, 0.02 oz.; Ag, 1.5; Fe, 3.6 per cent.; Zn, 52.9, and a high-grade pyrite product carrying the gold, silver, lead,

importance to ore dressing. The application in commercial detail will be more fully described at a later date.

## PRINCIPLES OF ELECTROSTATIC SEPARATOR

The fundamental principle of electricity, upon which the electrostatic machine is based, is that: Bodies charged with like kinds or polarities of electricity repel one another, while bodies charged with unlike kinds or polarities of electricity, attract one another. It utilizes, to effect separations of the minerals in ores, their differences in electrical conductivity. Most people are prone to confuse the term electrostatic separation with that of magnetic separation, but the two are based on entirely different principles. This difference should be clearly appreciated.

Every mineral, if subjected to a sufficiently high voltage (electrical pressure) conducts electricity to some extent, either through its body or over its sur-

face. As minerals differ in the readiness with which they conduct, it follows that when a mixture of minerals is subjected to a charging influence there will be differences in the time required for the different minerals to become electrically charged; and conversely, if all the minerals of a mixture become charged in some manner there will be differences in the time in which the different minerals become discharged when in contact with a discharging surface. Thus, if a mixture of fine copper grains (good conductors) and dry fine quartz grains (poor conductors), while in a neutral electrical condition, be brought in contact with a surface highly charged with electricity, the copper grains, because they conduct the electricity readily, become immediately charged to the same condition as the surface, and, if not too heavy, fly from it. The quartz, because a poorer conductor, requires a longer time to receive a charge from contact with the surface, hence clings to the surface, or, if the surface be in a suitable position, may drop off by reason of its weight.

If the mixture above mentioned be in some manner first charged with electricity of one kind and then subjected to

#### CLASSIFICATION OF MINERALS ACCORDING TO CONDUCTIVITY.

GOOD CONDUCTORS.	POOR CONDUCTORS.
<i>Most Sulphides:</i>	<i>Most Silicious Minerals and Rocks:</i>
Pyrite.	Quartz.
Chalcopyrite.	Quartzite.
Chalcocite.	Sandstone.
Galena.	Feldspars.
<i>Native Metals:</i>	Granite.
Copper.	Porphyry.
Gold.	Andesite.
<i>Some Oxides:</i>	Epidote.
Magnetite.	Garnet.
Hematite.	Calamine.
<i>Certain Arsenic and Antimony Compounds:</i>	<i>Most Carbonates:</i>
Pyrrhotite.	Calcite.
Tetrahedrite.	Limestone.
<i>Biotite.</i>	Siderite.
<i>Graphite.</i>	<i>Most Sulphates:</i>
	Barite (heavy spar).
	Gypsum.
	<i>Sulphide of Zinc (Sphalerite or Blende):</i>

contact with a surface charged with electricity of the other kind, the copper grains will instantly lose their first charge and leave the plate as before, while the quartz grains will cling much more tenaciously than before (because unlike charges attract one another), until the charge first received becomes neutralized by the charge on the surface, or until they are brushed off. Or, instead of moving the mixture of good and poor conductors progressively into regions of different electrical condition, to effect the separative action, the electrical condition of the surface upon which they rest may be very suddenly changed, whereupon the better conductors will more rapidly follow the electrical changes than will the poorer conductors.

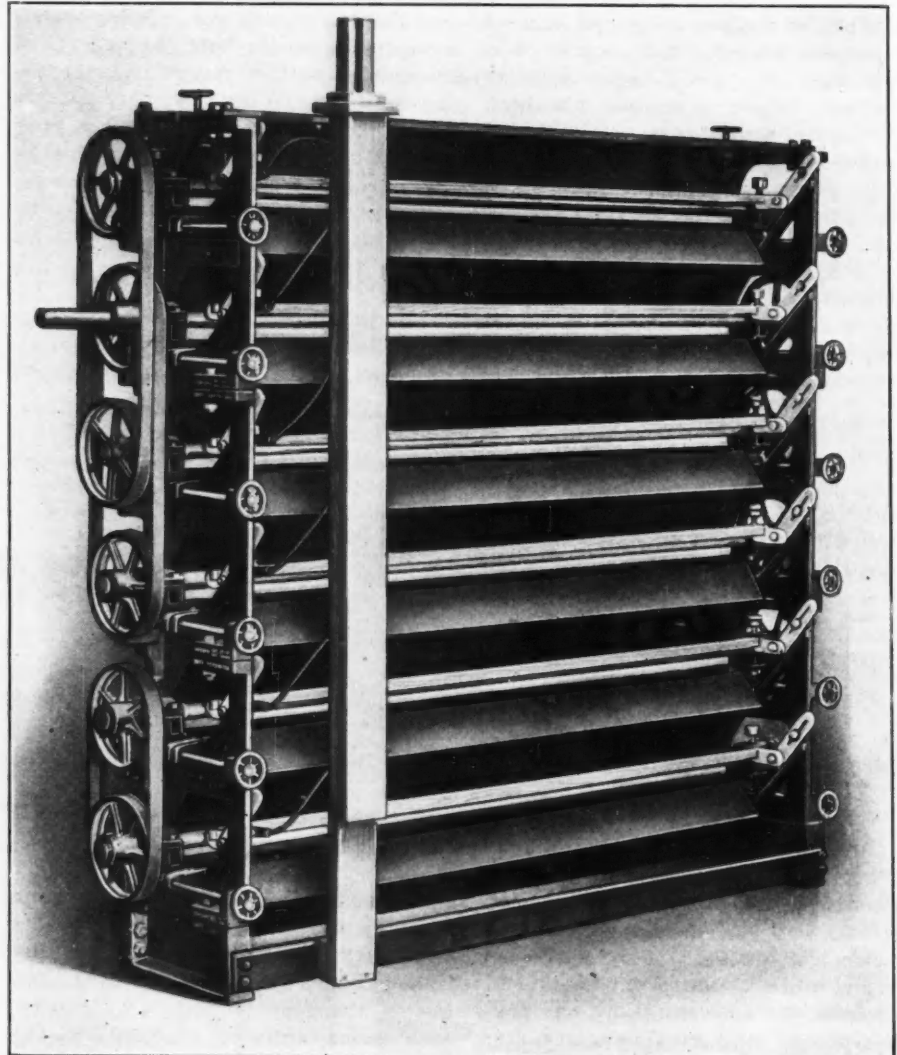
#### DIFFERENT EFFECTS UTILIZED

The various forms of electrostatic separators use these different effects in numerous ways. There may be vigorous repulsion of all the minerals of the feed,

but the better conductors will be repelled more vigorously, while the poorer conductors will cling tenaciously to the surface. Or there may be apparently no repulsion, the separation being made by the poorer conductors clinging more tenaciously to the surface than the better conductors. These actions are illustrated in the accompanying drawing, in which (1) is the path of better conductors with certain types of electrification; (2) is the path of poorer conductors with certain types of electrification, and of better conductors with other types of electrification,

often from one another in the same class. Although the minerals mentioned usually belong in the indicated list, this is by no means always the case. For example, garnet varies, according to its composition, from a very poor conductor to a fairly good conductor. The conductivity of blende in its natural condition is often, though not always, largely dependent on the amount of iron or manganese chemically associated with it.

In many cases where it is impossible to separate two minerals in their natural condition, the conductivity of one of the



THE HUFF ELECTROSTATIC SEPARATOR

and (3) is the path of poor conductors with some types of electrification. The use of these actions and modifications is protected in all important countries of the world by the fundamental and subsidiary patents of the Huff Electrostatic Separator Company.

#### MINERALS CLASSED ACCORDING TO CONDUCTIVITY

With regard to electrostatic separation, minerals may be divided into two general classes of good and relatively poor conductors. Of these, minerals of one class can usually be separated electrostatically from minerals of the other class, and

minerals may be altered by artificial means, such as by heat, by chemical or electrochemical action, etc. Thus certain poorly conductive carbonates may be converted by heat into conductive oxides; a poorly conductive zinc blende converted to a better conductor by electrochemical action; or a conductive blende rendered less conductive by a chemical bath. A list is given herewith of typical minerals showing their general relation to electrical conductivity.

An examination of the tables given herewith shows that electrostatic separation has a number of unique fields of great importance.

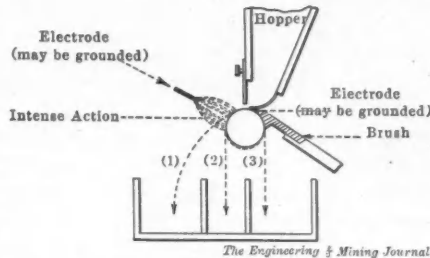


LARGE FIELD FOR ELECTROSTATIC SEPARATION

The electrostatic machine may be classed: As a general concentrator of sulphide ores from their gangues, and is particularly useful in dry sections where water is comparatively difficult to obtain; as a separator of copper, zinc and lead-silver ores from heavy gangues, such as garnet, barite, epidote, etc.; a concentrator of molybdenite, graphite, monazite, and for the solution of other such special problems in which water separation alone is not usually successful; a concentrator of pyrite for sulphuric acid, for by electrostatic separation there is produced a product high in sulphur with high recoveries of the sulphur present in the ore. Of course, one of the most im-

ly to the spaces in which the separations take place.

In the development of the electrostatic art one of the principal problems has been the production of the high-tension electricity and its application to the separator in such a manner that the opera-



ACTION OF ELECTROSTATIC SEPARATOR ON VARIOUS CONDUCTORS

significance in the recent rapid progress in the art are: The elimination of close supervision of the machines; the enlargement of the range in size of the material which can be separated electrostatically; the advance in the separation of materials lying comparatively close together in conductivity.

The attention now required by electrostatic separators is about the same as that required by concentrating tables, as the electrical conditions are now constant and any attention to the machines is that of a change or adjustment required by variation in the character of the feed. Electrostatic separation can now handle successfully material of which a large portion passes a 200-mesh screen, and also material which is coarser than 1/2 in. in diameter.

As an illustration of the recent advancement in the range of separation may be cited the work on the "black jack" zinc problem. Many such ores which have been considered inseparable from pyrite and chalcopyrite by electrostatic separation, because of their closeness in conductivity, can now be readily separated. Systematic and persistent invention is responsible for the success of electrical separation, and it has required the constant application of a number of carefully trained technical investigators, and the expenditure of a large sum of money to bring the art to where it is today. It is intended to bring this art to a high state of development, and to this end there is kept at the laboratories of the Huff Electrostatic Separator Company, at 60 India street, Boston, Mass., a force of technical men working on new developments.

COMMERCIALLY IMPORTANT ELECTROSTATIC SEPARATIONS.

Material.	Product.	Cu, Per Cent.	Fe, Per Cent.	Pb, Per Cent.	Zn, Per Cent.	SiO <sub>2</sub> , Per Cent.	Ag, Ounces.
Low-grade chalcopyrite in quartz.....	Original	2.56	17.8	....	....	....	2.6
	Concentrates	5.63	37.2	....	....	....	5.5
	Tails	0.10	2.0	....	....	....	0.4
Pyrite and chalcopyrite in various gangues.....	Original	6.37	25.0	....	....	....	....
	Concentrates	9.33	36.3	....	....	....	....
	Tails	0.14	1.9	....	....	....	....
Chalcopyrite and bornite in garnet.....	Original	3.60	18.6	....	....	32.3	(Iron partly in sulphide and partly in garnet.)
	Concentrates	19.10	25.7	....	....	14.4	
	Tails	0.34	17.6	....	....	36.7	
Zinc-iron-silver ore.	Original	2.61	23.8	13.9	19.4	....	52.8
	Concentrates	3.33	30.7	16.4	6.4	....	69.0
	Tails	0.91	3.4	2.7	51.8	....	4.6
Zinc-lead-iron midlings.....	Original	....	20.2	12.6	23.1	5.2	....
	Concentrates	....	31.2	21.0	4.0	3.2	....
	Tails	....	2.4	0.5	53.8	8.5	....
Table concentrates....	Original	2.11	16.2	....	29.9	19.9	....
	Concentrates	5.65	37.2	....	4.9	6.6	....
	Tails	0.13	4.2	....	44.9	15.9	....
Zinc from above tails..	Concentrates	....	....	....	57.1	....	....
	Tails	....	....	....	1.3	....	....

portant applications of the electrostatic art is the separation of blends from the several minerals which it so closely resembles in specific gravity. Another important application to which the process has recently been put is the concentration of high-grade silver ores, where by water concentration it is impossible to make high recoveries and also obtain a high-grade shipping product.

CONSTRUCTION OF THE HUFF MACHINE

The Huff electrostatic separator, as now developed, is constructed in several forms, one of which is shown in an accompanying illustration. This machine is constructed almost entirely of metal and there are no shaking parts. It consists of a series of separating electrodes, placed one above the other, two to eight in number, depending upon the requirements of the ore to be handled. The separator is built of cast-iron sections, two electrodes to each section, which arrangement allows convenient shipment and flexibility in the number of electrodes used. The electrical fields are concentrated and confined almost entire-

ly to the spaces in which the separations take place. The capacity of the Huff separator is variable, depending upon the size of the particles of the material treated, the difference in conductivity of the ingredients, and the grade of products it is desired to obtain. It ranges in general from four or five tons on the finer material to 15 or 16 tons on coarser sizes. The mechanical and electrical power will average about 1/2 h.p. per machine.

tion of the separator is constant at all times and unaffected by any atmospheric condition. This has been accomplished and the electrical apparatus, as now used, consists of a single generating outfit placed as a rule in the engine room of the mill, under the supervision of the engineer, and receives about the same amount of attention as the electric lighting plant. This special electrical machinery is entirely and radically different from the static machine and not at all subject to the troubles of the latter.

RECENT DEVELOPMENTS IN MACHINE

Besides the development of the highly satisfactory electrical equipment, and the metallic machine, the factors of most

Mineral Production of Chile

The mineral output of Chile, compiled by La Sociedad Nacional de Minería is given in the accompanying table. The production of copper for 1909 was slightly in excess of that of 1908, and is second in importance, sodium nitrate be-

MINERAL PRODUCTION OF CHILE.

	1908.		1909.	
	Kg.		Kg.	
Gold .....	1,188.5	1,268.4		
Silver .....	52,435	44,282.5		
Copper .....	42,096,731	42,726,145		
Manganese minerals .....	1,000	....		
Lead .....	9,722	1,200		
Mineral specimens..	3,433	....		
Iodine .....	330,090	474,200		
Potassium chlorate..	54,500	92,220		
Borax .....	35,039,038	32,218,042		
Salt .....	1,625,700	2,046,300		
Sulphur .....	2,704,722	4,507,707		
Sulphuric acid.....	797,000	1,415,000		
Guano .....	870,800	10,691,845		
	Metric Tons.		Metric Tons.	
Coal .....	939,836	898,971		
Sodium nitrate.....	1,970,974	2,101,512		

ing first. The latter was 1,970,974 metric tons in 1908, and 2,101,512 tons in 1909, amounting to over \$76,000,000. Coal occupies the third place in the mineral output, while next in order are iodine, borax, silver and gold.

# History and Review of the Niter Industry of Chile

Modern Methods Not Used; Labor-saving Machinery Not Practical under Existing Conditions; Extraction Process Might Be Improved

BY MARK R. LAMB\*

Semper and Michels, Santiago, Chile, have published (1908) an exhaustive review and history of the niter industry of Chile. The recent continued discovery of large areas of what are expected to be commercial deposits of sodium nitrate in the arid regions of Arizona, Nevada and California should add much interest and value to the new book in the eyes of the western prospector as well as fruit-grower. It is written in Chilean Spanish and contains about 400 pages with numerous illuminating sketches, photographs and maps. It is based largely upon the monograph prepared on this subject by Professor F. A. Sundt for the German Government. The text is divided into three general parts to which has been added an appendix which corrects figures of production and cost to date besides bringing up to the moment of publication the histories of the numerous "combines" and "committees" organized for the purpose of marketing the niter.

## FOUR ZONES

Part one, which is accompanied with sectional drawings (Figs. 1, 2 and 3) and maps of the coastal niter desert, gives detailed geographical descriptions of the various deposits. The strip of the west coast of South America, where no rain falls and which is nearly destitute of vegetation, is over 1300 miles long, extending from 4 deg. to 26 deg. south latitude. From the latter point the rivers are more frequently seen, and vegetation begins to show a short distance north of Valparaiso. This work refers only to the northern portion of Chile where rain is very rare, that is in the provinces of Tarapacá and Antofagasta.

Fig. 1 shows how readily the region divides itself into four distinct zones. These zones, which lie parallel with the coastal line, are the steep coast range, a flat valley or plain, the foothills of the cordillera and the lofty, snow-clad Andes. The aridity of the plain is clearly chargeable to the high mountains. The warm, moisture-laden air from the lowlands of the valley of the Amazon is never able to pass this barrier with its burden. The moisture of the afternoon sea breeze from the Pacific but rarely, and only in winter, condenses to the point of forming a light shower. Almost daily the moisture of this breeze forms over the desert a high fog or cloud which disappears with the rising sun. This is always ac-

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companied by high-tension electrical conditions which frequently interrupt telegraph and telephone communication.

The geology of the rock upon which the niter deposits rest is touched upon only lightly by the authors as having no influence on the niter.

## OCCURRENCE OF THE NITER

Pure sodium nitrate in a crystallized state is found only in minute quantities. The material from which the commercial product is extracted is a mixture of that salt with chlorides and sulphates and with earth and rock. As the word *caliche* is used to designate all grades of this material which are made to yield niter, it cannot be given a petrographical definition. The various layers of niter-

tions in decomposed porphyry and as surface efflorescence, these forms are of no practical importance.

## ORIGIN NOT KNOWN

The question of the origin of Chilean niter has occupied the attention of many notable men who have formulated the most diverse hypotheses without having arrived at a satisfactory solution of the problem. The theory based on the decomposition of marine algae, first proposed by Noellner and the one most frequently met in chemical and geological books, is declared to merit least consideration, since neither bromic nor phosphoric acid nor fossils of marine organisms have been found in the niter beds. The theory of Muntz and Plagemann is

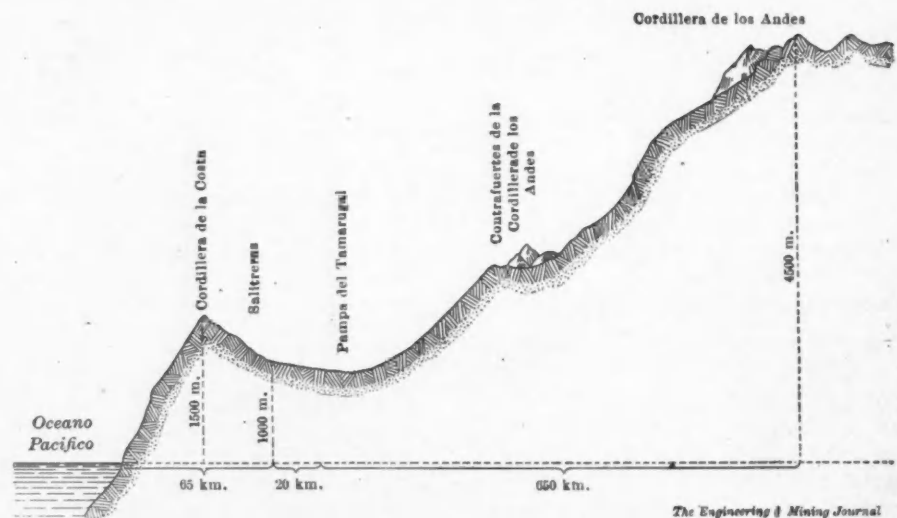


FIG. 1 IDEAL SECTION OF CHILEAN COAST REGION

bearing material are given local names which vary with the relative position and other characteristics of each.

The sketch, Fig. 2, shows a typical working with the various layers indicated. Briefly, *chuca* is the loose, top dirt, *costra* is a conglomerate layer of rock cemented with common salt and a low percentage of niter, *caliche* is the same but with a workable proportion of niter, *conjelo* is a layer of sulphates and chlorides of soda, calcium and magnesium, and *coba* is loose earth containing the above mentioned salts in very small quantities.

If exceptions prove the rule, then the above brief description must be perfect, since the authors give a bewildering list of variations in content, arrangement and physical condition of these layers in the various fields. Although niter occurs as cavity filling in limestone, as impregna-

based on the decomposition of organic matter under the influence of a nitrifying organism (*fermento*). Semper and Michels deny that there is any foundation for the belief that there were ever animals or vegetables in the Andes in sufficient quantities to justify this theory. The guano theory of Ochsenius, based on first transforming large salt marshes into sodium carbonate deposits by means of carbonic acid from volcanic sources and with a further change to nitrate by the transport of guano from sea islands by air currents, is proven widely improbable.

The theory of the formation of niter by electric tension in humid air has the support of the practical operators on the field, though it is frankly admitted that it does not account for the presence of niter in the Salar de Maricunga, 12,000 ft. above and 100 miles inland from the

sea. It is a problem reserved for a geologist to solve by means of comparative investigation of the conditions of the various beds by chemical analysis and perhaps by meteorological investigations.

The fabulous and sensational announcements of discoveries of niter in California which were made by New York papers in the autumn of 1902 created great alarm—in Chile. These reports resulted in an investigation by Gilbert E. Bailey and the publication of *Bul. No. 24* by the California State Mining Bureau. Extended quotations are made from this bulletin. It is shown that there is little similarity in the deposits. The final and important point made is that though Bailey expected the developments of that year (1903) to disclose workable deposits of niter, no such discovery had been made up to the time of going to press.

#### PROSPECTING BY DRILL HOLES

Seventy pages are devoted to a minutely detailed description of the prospecting, proving, mining and treatment of the *caliche*. Before the land is acquired and before beginning development or exploitation the ground is proved by a series of small shafts, 300 to 1000 ft. apart. If one of two neighboring holes does and the other does not show *caliche*, a third hole is sunk between them to delimit the valuable ground. These latter holes are put down as close together as 150 ft., depending on the aims of the examination and the time at disposal. Maps are made indicating the location of these holes and each is carefully sampled and assayed, so that from the assay maps the niter content of the deposit can be closely estimated. A loss of at least 15 per cent. is sustained in mining the *caliche* and a further loss of from 5 to 15 per cent. is made in extracting the niter in the works. The test holes are made 12 in. in diameter and are bored with round steel bits with four cutting edges. These bits remove the surface dirt. The hard rock is broken with dynamite and then removed with a "spoon."

The large number and slight depth of the holes has suggested the use of a boring machine, but besides the fact that the hardness of the different layers varies most extraordinarily, the subsoil is too porous to permit the use of water in boring; further, the continuous transfer of the machine from one hole to another would be difficult on account of the softness of the surface; and finally on account of the difficulty of making machine repairs on the desert it is out of the question to do this work by mechanical means. The drillers are paid by the foot and the price varies from 13c. to 39c. per foot. (This part of the book was written in 1902—brought up to date in the appendix—and the rate of exchange is taken at 16d. for one *chileno* though the nominal value of the *chileno* is 18d. and the present actual value is much less.)

Contractors on this drilling purchase dynamite, fuse and caps of the company. One of the difficulties of contracting this work is that the contractor, in order to make rapid progress, will work where the ground has been cut by ravines, or on the edges of irregular ground and not in the center. As the layers are not uniform at these points but are usually washed out, such holes cannot be used for sampling. Much vigilance is therefore required and when time permits it is better to do this work with day labor.

The practical laborer can usually estimate within a few per cent. the value of a *caliche*, but where, as in Aguas Blancas, this estimation is not so simple due to the presence of much sulphates and other salts, an incandescent wick is sprinkled with pulverized *caliche*. The vividness and liveliness of the sparkling and exploding of the material indicate its content of niter to the experienced. For a more accurate assay a weighed portion of ground *caliche* is dissolved in hot water, strongly acidulated with  $H_2SO_4$  and titrated with a standardized solution of ferrous sulphate. The solution is kept hot during titration, and the final reaction is indicated when a further drop produces no addition to the brown discoloration, or better, does not intensify the color of the solution.

#### MINING BY CONTRACT SYSTEM

The technics of the actual mining of the *caliche* have varied little if any since the beginning of the industry. This mining is done by contract or stint. Where layers are of uniform thickness the working faces are connected into a cut whose direction depends on the lay of the land. In the language of the *pampa*, this blasting of holes, connecting working pits into long cuts, etc., constitutes the operation of "opening a *caliche* deposit." In opening this cut a number of holes are blasted, the valuable *caliche* being separated from the waste which is piled to one side. The mining advances in an irregularly perpendicular direction to the length of the cut, the drillers working ahead of those who sort the *caliche*.

The blasting or mining holes are drilled as are the prospecting holes. The bottoms of these holes are enlarged (see Fig. 2) in order to have greater capacity, and this enlargement is done by very small boys who are lowered to the bottom. The ordinary explosive is a powder made locally of niter, carbon and sulphur. A charge of powder varies from 100 lb. to 300 lb. The loosened *caliche* is separated, cleaned and piled for transportation to the *oficina*, or works. The loss due to the mixing of fines with the waste is given as from 15 to as high as 25 per cent.

The workers are paid by the cart-load and as no requirement is made as to working time or minimum daily area, it often happens that a working is aban-

oned without the separation of the *caliche* when the workman cannot see a good profit. Other contractors will not take up an abandoned face, so that large areas of good ground are thus permanently abandoned. A workman extracts from 5000 to 10,000 lb. per day, in the average working.

A good, economical management depends largely upon the judgment and the practical and technical knowledge of the manager. Even at the present time there are plants whose managers have in view only a present profit. At these plants only the rich ground is being opened. The poorer deposits have been left, but as the better portions become exhausted the exploitation of the poorer becomes necessary, though at a greater expense than would have been the case in the first instance. Grades of material as low as 18 per cent. are now perforce being treated.

The *caliche* is hauled to the works in two-wheeled carts of 4500 lb. capacity, drawn by three mules hitched abreast. A second man on muleback picks out the best road for the cart and helps over the bad spots with his mule. Industrial railways are rarely used as the points for loading shift so rapidly.

#### MINING COSTS

In the south where the niter industry is new, wages are not so high as in Tarapacá, where laborers are scarce and socialistic associations (i.e. unions) have assisted in greatly raising wages during the last few years. Drillers receive 50c. per hole, and the powder costs 62c., making a total cost of \$1.12 per hole.

As one shot loosens about seven cart-loads, the cost of drilling and powder per cart-load of 4500 lb. is 16c. The cost of making the pockets (the work done by boys) in only 6c. each. A clear, graphical representation of the varying costs of drilling, blasting, sorting and transportation as influenced by grade, thickness and locality of the different strata is given and is more illuminating than many pages of written explanation. When ground is being worked over a second time a cart-load costs 42c., while a similar quantity costs \$3.50 when obtained by underground mining.

Tool sharpening averages 4c. per cart-load. The cost of transportation by a combination of carts and industrial railways is figured in detail based on a daily capacity of 250 tons and amounts to 21c. per ton. This cost is reduced one-half in cases where the works are near the deposits and no rail transportation is provided. Where it is difficult to distinguish the niter deposits from the sulphates, skilled inspectors are required which add as much as 2c. per ton to the cost of mining. The total average cost per ton of the *caliche* at the works, therefore, is as follows: Drilling and shooting, 10c.; sorting,

64c.; tool sharpening, 4c.; haulage, 24c.; inspection, 4c.; total, \$1.06.

If the *caliche* contains 30 per cent. niter and an extraction of 22 of these is secured, the cost of exploitation is \$4.90 per ton of niter. It should be remembered that these costs, given in U. S. currency, may not be exact owing to the fluctuating rate of exchange for the Chilean money, in which the laborers are paid.

#### NITER EXTRACTED BY LIXIVIATION

The operation of extracting the niter from the *caliche* consists essentially in the lixiviation of the latter material at a high temperature, in the separation of the insoluble portion from the solution obtained, and finally in the precipitation of the dissolved niter by crystallization. Although this mechanical process seems easy, its realization on a large scale presents many difficulties, the industrial results depending upon the greater or less perfection with which these difficulties are overcome. The solubility of pure niter is very different from that of

but once. Of course only the richest beds could be worked thus.

#### THE HUMBERSTONE METHOD

In 1853 the use of steam in larger tanks was introduced, and in 1880 the closed-circuit coils of steam pipes were introduced by Humberstone, and this is, with only slight modifications, the process used today. The loaded cars and carts are dumped into bins with inclined bottoms from which the material is drawn to the crushers. A Blake crusher, with a feed opening 15 in. wide and with a consumption of 10 to 12 h.p., has a capacity of 15 tons per hour crushed to fist size. The crushed *caliche* falls into cars and is trammed to the *cachuchos* or lixiviating tanks. These rectangular tanks are 30x8x8 ft., made of  $\frac{3}{8}$ -in. steel and usually set in series of six. A false bottom of perforated plates is set 6 in. above the real tank bottom. Two bottom-discharge doors are provided in each. The tanks are supported on columns and tracks run underneath for the discharging cars. The lixiviation process con-

pedite the circulation of the solution, though this can be effected slowly by gravitation.

Three sets of piping are connected to each tank to supply the "mother liquor," the wash solution and water. A cycle of operations, covering a series of six tanks in various stages of treatment, is described in detail in the book. Briefly, this consists in washing each new charge of *caliche* with the partly saturated hot solution from the tank preceding it. This gives the final saturated solution which is run to the settling tanks and thence to the crystallizing tanks. At the other end of the series the tank of material which is about ready for discharge is given a final wash with cold water. Varying temperatures of solution are therefore found between the cold water and the final concentrated *caldo*. The higher the concentration the purer the crystallized niter but the last few possible degrees of concentration require prolonged boiling and it is a question of practical finance to determine the most profitable point of saturation.

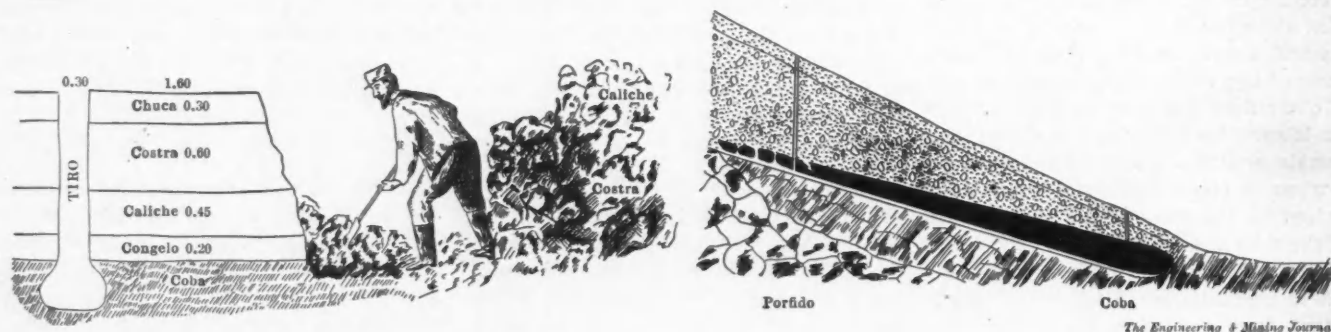


FIG. 2 METHOD OF WORKING AND IDEAL SECTION OF CHILEAN NITER DEPOSIT

the niter in *caliche*, where it is mixed with other salts.

Chloride of sodium, which is always in the *caliche*, exercises the greatest influence. While at ordinary temperature water dissolves 85 parts of niter, in the presence of chloride of sodium only 53 parts are dissolved together with 26 parts of salt. At 120 deg. C. water dissolves 220 parts of niter and its dissolving power of for salt is reduced to 15 parts. The other salts play a similar though not so important part. This is the basic fact upon which the method of extraction rests and it can be stated even more briefly: In a mixture of niter and other salts, the solubility of the former increases and of the others decreases with increasing heat.

The graphical diagrams, Fig. 3, showing relative solubilities of salts taken separately and together, is worthy of careful study and shows the influence of mixtures on solubilities. In ancient times the process consisted in boiling the *caliche* in kettles of three to four feet in diameter. The concentrated liquor was decanted and its niter content crystallized out while the residue was usually washed

sists in a systematic concentration of the "lye" or "broth," taking advantage of the fact that niter is more soluble "in the hot" and that the other accompanying salts are less soluble "in the hot."

The tank content is heated by six or eight coils of steam pipe fed with live steam under pressures up to 70 lb. gage. The heating of each tank can be controlled individually. The condensed steam returns by gravity to the boilers. The solution passes from one tank to the next in series until it is sufficiently saturated with niter, when it is allowed to drain off through a valve in the side of the tank. The circulation of the solution from one tank to the next is by means of pipes extending from below the false bottom to near the level of the top of the tank. In the upper third of its length this pipe is connected to the next tank. The solution from any tank is drawn from beneath the false bottom through this pipe and discharged on the surface of the next in series. These pipes or siphons are arranged in diagonally opposite corners so that the solution must flow the length of a tank before it discharges to the next. A centrifugal pump is often used to ex-

#### EFFECT OF TEMPERATURE ON THE PROCESS

The mother liquor does not accumulate disturbing quantities of foreign salts because in the dissolving process the capacity of the liquor for niter increases with the temperature, while the solubility of salt and sulphates diminishes, so that when the niter content of the *caliche* is dissolved the other dissolved salts crystallize out in the tanks. This action is clearly seen in the last tank from which the finally concentrated solution flows. Each charge is heated 22 hours, the final wash requiring three hours. An hour is required for discharging a tank. The discharged material contains not less than five per cent. of the original content of niter, and often contains much more.

The concentrated solution is clarified before being allowed to cool, since it contains fine mud in suspension. This clarification is more important in plants which do not produce concentrated solutions, since while the mud is settling, and due to the partial cooling, part of the salt content crystallizes out. For example, if for any reason the niter necessary for saturating the hot solution is not taken up, its density at 100 deg. C. cannot reach

107 deg. Tw. and the liquid will be saturated with salt only.

Let us suppose that the result is a solution of 102 deg. Tw. At this density, according to the table or diagram, Fig. 3, the temperature should be 85 deg. C. The liquid contains then 1314 grams of niter and 166 grams of salt per liter, besides *x* grams of salt which the liquid dissolves by reason of the extra 15 deg. of temperature. Hence, if the temperature lowers to 85 deg. C. niter cannot crystallize out, but the *x* grams of salt will do so. If the temperature is then lowered still further, niter will crystallize but no more salt will deposit, since, according to the diagram, the capacity of the solution for salt increases inversely with the temperature.

the niter is heaped at the high side of the tank to drain. From here it is carried to storage bins and sacked for shipment. The mother liquor is used over again. The accompanying analyses are good examples of average shipments. Formerly the niter was shipped in sacks of 130 to 140 kilos, but a recent "hygienic" government regulation has reduced the maximum to 100 kilos.

ANALYSES OF NITER SHIPMENTS.

	Per cent.	Per cent.
Nitrate of sodium.....	94.164	94.245
Nitrate of potassium.....	1.763	1.249
Chloride of sodium.....	0.933	1.180
Iodate of sodium.....	0.010	0.017
Perchlorate of potassium	0.282	0.239
Sulphate of magnesium...	0.219	0.303
Chloride of magnesium...	0.289	0.342
Calcium sulphate.....	0.102	0.041
Insoluble .....	0.138	0.174
Molsture .....	2.100	2.210
	100.000	100.000

ing 20 per cent. *caliche*, is \$4.10 per ton of niter. A minimum cost, treating 32 per cent. *caliche*, is \$2.12 per ton.

Iodine, which is a by-product and which is in the solution as  $\text{NaIO}_3$ , is precipitated from the cooled mother liquor by adding an excess of bisulphate of sodium until a standard brown color is produced, and by then adding about one-quarter the volume of liquor. This is a rather delicate reaction since with too much liquor the precipitation is incomplete, and with too much bisulphate precipitation goes on in the leaching tanks after the liquor is again in circulation. The precipitate, containing 70 to 75 per cent. of iodine is pressed, dried and re-torted, the condensed iodine being remarkably pure, approximating 99.6 fine.

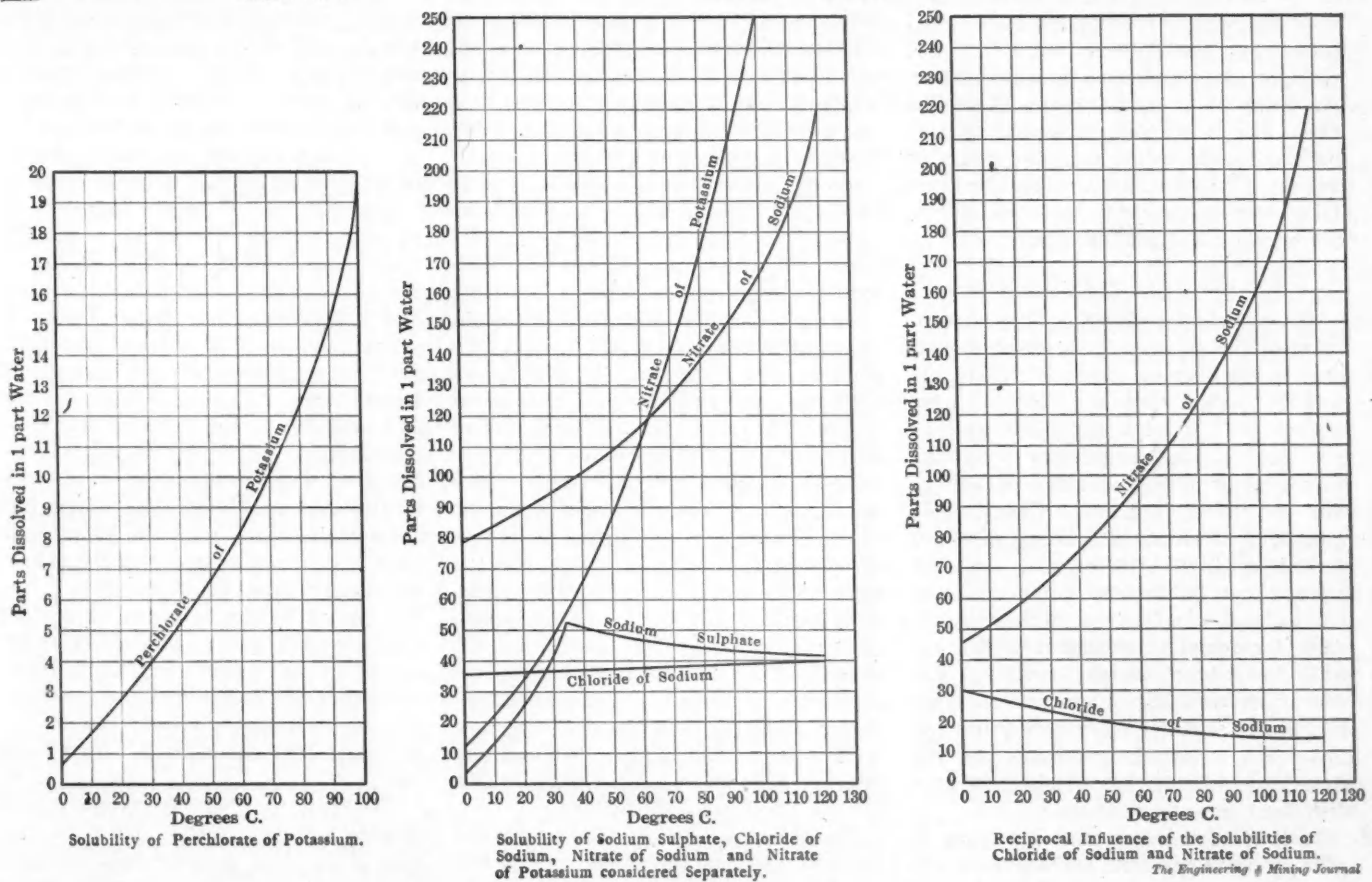


FIG. 3 SOLUBILITIES OF SALTS CONCERNED IN EXTRACTION OF NITER

This necessity for a slight cooling of the non-saturated solution has given the name "coolers" to the settling tanks. One works manager tried to omit the use of these tanks, but the niter produced contained so much salt, even after sprinkling with water and draining, that the coolers were required after all. The fact that the settled mud contains about 50 per cent. of salt shows the importance of this preliminary cooling.

LOSSES AND MANUFACTURING COSTS

The crystallizing of the niter is carried on in tanks 15x15 ft. They are 33 in. deep and set on a slight incline. The concentrated solution stands five days in these tanks, when it is withdrawn and

Taking all treatment losses together, such as that in the mud of the coolers, by leakage, in the residue and in dusting at the breakers, the total is about eight of the contained per cent. of the niter in the *caliche*. For example, a 40 per cent. *caliche* is figured as having 32 per cent. available so that this eight per cent. is really 20 per cent. of the actual content. To this should be added the 15 per cent. lost in mining. The consumption of coal varies from 200 to 1000 lb. per ton of niter produced. An average of 400 lb. per ton of nitrate is given. The book attempts to give an idea of the cost of manufacturing the niter, but with such widely varying conditions no average can fairly be stated. A maximum cost, treat-

The cost of production is 2.5c. and the selling price in Europe is 11.5c. per ounce.

Perchlorate of potassium, common salt and soda can be considered only as impurities and have no commercial value on the *pampa*. Bisulphate of soda, used in precipitating iodine, is prepared by passing sulphurous acid through soda solution. Lime, used in purifying water for boiler and drinking purposes, is burned in the central region of Tarapacá.

PROCESS COULD BE IMPROVED

Referring to the imperfections of the process, the book states that theoretically the concentration of the solution should be carried to the limit before crystallizing out the niter, but that 110 deg. Tw.

is the practical limit, and even this point is attained, when treating low-grade *caliche*, with an unwarranted and uneconomical consumption of fuel. It would appear logical to leach the *caliche* in agitators, but the nature of the raw material does not permit this as it contains a large proportion of fine material which, when agitated, forms a mud which leaches and washes with difficulty. (The modern vacuum filter has evidently not been seen in Chile.) The present process with all its advantages leaves much to be desired. The steam pipes in the leaching tanks are much in the way and greatly increase what would, without them, be the cost of discharging the tanks.

The high cost of water and of coal on the *pampa* has resulted in many attempts at improvements in the process to save heat and water by operating with closed tanks, but the difficulty of filling and emptying such tanks has been prohibitive. Nordenflycht is quoted to the effect that about 265 lb. of coal are wasted in evaporating water in the final five hours of heating of each charge. This does not take into account the heat lost during the other 17 hours of treatment.

#### TOO MUCH NITER IN RESIDUES

The principal problem in the improvement of the process is to secure a residue really poor in nitrate. During the last ten years the actual content has been 14 per cent., though managers quote 5 per cent. The reason for this incomplete extraction is that the lumps of *caliche* are imperfectly leached. Considerable quantities of saturated solution, also, are locked up in the lumps and are not washed out before the latter are discharged. It is a fact that to date the efforts for complete treatment of the *caliche* have been overshadowed by endeavors to show low treatment cost. Only one works, treating very low-grade *caliche*, now successfully crushes by the American method, thus obtaining a product finer than the ordinary.

In spite of the fact that from year to year it becomes more necessary to effect a better saving and that the greater cost of a more nearly perfect leaching obtained by using weaker solutions would be offset by the higher extraction, none of the evaporation processes of other industries have been introduced. By the present method a large amount of heat is lost in the tailing. Although the residue is given a final wash with cold water, nevertheless it reaches the waste heap at a relatively high temperature. For this reason it has seemed feasible (though without practical result to date) to leach the *caliche* cold and finish the treatment at the coast. The solution resulting from such cold leaching would be weaker but the extraction would be better, and as distilled water can be sold to advantage at the ports the solution could be evaporated. A careful study shows that the cost

of the cold treatment would be less than that of the present method.

Labor-saving devices are not economical installations on the *pampa* on account of the cost of fuel and because on the desert complicated machines are likely to give rise to detrimental interruptions in the works operation. But as each day sees the labor become more scarce it cannot be doubted, for example, that conveyor belts for filling the tanks could advantageously replace manual labor.

#### EARTHQUAKES LIMIT CONSTRUCTION

The choice of a site, depending on transportation facilities, nature of subsoil, topography, etc., is discussed in detail. The frequency of earthquakes has made inadvisable the erection of any but one-story cement buildings. The tanks are made of 10-mm. ( $\frac{3}{8}$ -in.) steel plate. The steam engines, crushers, pumps and electrical machinery are almost exclusively English and American. The boilers are of the large Cornwall type, many being of German manufacture. A steam pressure of five atmospheres is used in heating the *caliche*, while ten atmospheres pressure is employed in the steam engines. One works, the Santa Fé, is operated by electric power from the Loa river.

The provision of water for domestic and works use has resulted in a network of pipe lines from the foothills of the Andes and from various wells in the desert. The minimum loss and cost of water per ton of niter produced is given as 250 gal., worth 13c. The wells, which supply a part of the water, give a product which always contains more or less of various salts in solution. Well water is used on the works and part of it is partially purified and diluted with distilled or mountain water for the use of the animals. The cost of constructing the pipe lines of the Santa Lucia works exceeded \$300,000, and the resulting cost is 18c. per ton of water. The railway company sells water to the works for 25c. per ton, or \$1 per 1000 gallons.

The mules, of which a large number are used, are from the Argentine and forage is obtained from southern Chile. The various works run company stores and charge prices which afford a profit of 30 to 50 per cent. (This statement is modified by a footnote of later date to the effect that the companies now sell at cost.)

#### COST FACTORS

The various items which go to make up the maximum and minimum cost of a ton of niter on the shipping platform, less the profit of the company stores and not including cost of sacking, amortization or interest on capital invested, are reviewed, the totals being \$17 and \$4 respectively. (Again a footnote modifies these figures by calling attention to a raise of 30 per cent. in salaries, of 20 per cent. in wages, of 20 per cent. in cost

of materials, of 30 per cent. in cost of coal and of 70 per cent. in cost of forage. An average is therefore struck at \$12 per ton of niter.) To this must be added the export duty, the main source of revenue of the Chilean government, which is now \$11 per ton of niter. An attempt is made to estimate the cost of a complete plant. The cost of a complete plant is \$750,000, on a basis of a production of 5000 tons of niter per month from 32 per cent. *caliche*.

#### COMBINATIONS RAISED PRICE

The third part of the book is devoted to the economic and legal conditions of the industry and explains the various titles under which the land is held, the history of the acquisition of the territory from *el Perú*, the variations in exchange, banking, foreign debt and selling prices, the attempt of the government to make the industry a federal monopoly, the history of various companies and combines, and the outlook for the industry, all of which make interesting reading but are of no present value.

The assaying of *caliche* for niter, and of mother liquor for iodine is given in full. The legislation and judicial decisions bearing on this industry are ably and interestingly set forth. Tables are given covering the annual production since the beginning, covering variations in freight rates and giving details of owners and companies. The terms of the various combinations of producers (there were seven of these combinations) are given in full and are interesting. Invariably the combinations raised the price of the niter, and invariably the price broke badly with the breaking of the combine.

A review of the synthetic methods of producing nitrogen compounds is of particular interest to niter producers. Many authorities are quoted and the conclusion arrived at is that synthetic nitrates will not enter into competition with Chilean niter.

The book ends with a complete bibliography of the industry and a sectional map of the west coast of South America from La Quebrada de Camarones to and including the district of Taltal. In conclusion it may be noted that the *Bull.* of the Carnegie Library of Pittsburg, March, 1909, gives a list of 65 articles and books which touch upon this subject.

The California Court of Appeals has handed down a decision to the effect that an electric-power company has a right of condemnation of land for the purpose of erecting towers and stringing wires between them to furnish electricity for power purposes. The court also holds that the choice of route lies with the power company so long as it is shown to be acting on good faith, and that the landowner cannot object if the power company selects any particular location for its line.

# Data on Mortality and Morbidity of Miners—II

Experience Shows That High Accident and Disease Liability Makes Sickness Assurance for Miners Feasible Only at an Increased Cost

BY FREDERICK L. HOFFMAN\*

In commenting upon the sickness experience in selected occupation groups, it is pointed out by the Manchester Unity that "the accident risk is believed to constitute a serious portion of the liability but probably does not wholly account for the extraordinary excess of claims which the inquiry reveals." They therefore considered the mining group separate and apart from all the others, holding that it would be impossible to enforce the necessary amount of extra payments to place the mining lodges upon a sound and solvent basis. For this reason they refrained from calculating special monetary tables useful for the purpose, since it was obvious that whatever recommendations might be made could

ness among miners. The actual and relative differences diminish in old age, due to the universal tendency in all friendly societies to convert a sickness liability more or less into a superannuation benefit.

### MINING LODGES IN DANGER OF FINANCIAL DISASTER

The foregoing data are derived from the experience of the Manchester Unity, representing the society's experience for the period, 1893-97<sup>1</sup>. The results have since been fully confirmed by the Eighth Valuation of the Assets and Liabilities of the Lodges and Districts, made by Alfred W. Watson and Samuel Watson, actuaries to the Unity, published in 1909. In

tality or in utter disregard of the lessons of past experience.

### ONLY SICKNESS ASSURANCE FEASIBLE

The Eighth Valuation of the Manchester Unity brought out the fact that the percentage of actual to every 100 cases of expected-sickness cost was 125 for various hazardous occupations, 140 for men employed chiefly in iron and steel works, 152 for men employed chiefly in quarry work, and 159 for men employed chiefly in mining. Since the excesses in the mortality and sickness of miners is almost entirely the result of an enhanced accident liability it has been suggested as the only alternative "to expunge the accident benefit from the rules and to insist upon the concentration of the resources of the lodges . . . upon the sickness assurance, the preservation of which, of the two, is undoubtedly the more necessary to the member"

It has been pointed out in this connection in the report on the eighth valuation that:

"It has been repeatedly stated that the claims for accidents were greatly increased by the first Workmen's Compensation Act, and have been further augmented by the provisions of the Act of 1906 with reference to the period, dating from the beginning of incapacity, as at which the liability of the employer begins. It has also been asserted that the acts have operated prejudicially in respect to the ordinary sickness benefits in having rendered aged and infirm workmen less eligible for employment. We do not doubt that these arguments have foundation in fact, but we have never resorted to them in our consideration of this subject. From the actuarial point of view the case is absolutely established by the results obtained in connection with the experience investigation."

### INCREASED ACCIDENT LIABILITY DUE TO COMPENSATION ACT

In other words, it is admitted that the Workmen's Compensation Act has resulted in a material increase in liability resulting from accidents since 1897, confirming in this respect the impartial and thoroughly qualified conclusion of Sir Thomas Oliver, who for many years has lived in the heart of the Northumberland and Durham coalfields.

In reply to the suggestion that a special table of contributions should be submitted in which no provision should be made for an accident liability in the case of coal miners, the actuaries of the so-

TABLE VIII. MANCHESTER UNITY—I. O. O. F. EXPERIENCE—1893-97. (NUMBER OF MEMBERS SICK IN A YEAR AMONG 100 MEMBERS EXPOSED TO RISK.)

Ages.	Whole Society.	Agricultural and General.	Miners.	Actual Excess of Miners over Agricultural and General.
16-19	28.66	26.02	41.42	15.40
20-24	24.45	22.45	38.15	15.70
25-29	23.49	21.37	38.61	17.24
30-34	23.62	21.51	39.09	17.58
35-39	24.08	21.81	39.78	17.97
40-44	25.48	23.27	41.67	18.40
45-49	27.06	24.80	44.57	19.77
50-54	29.51	27.35	47.46	20.11
55-59	33.70	31.57	51.47	19.90
60-64	39.81	37.56	59.34	21.78
65-69	49.21	47.44	68.17	20.73
70-74	60.60	59.02	77.82	18.80
75-79	73.18	71.99	87.10	15.11
80-84	85.15	84.28	98.02	13.74
85-over	94.01	93.48	86.36	-7.12

not be enforced by the society on account of the great increase in contributions. A material reduction in benefits for the same contribution would, therefore, be the only alternative except in so far as relief has been furnished by the workmen's compensation acts.

Since information of this kind is practically unavailable to the general reader I include Table VIII showing the specific amount of sickness per annum, or the number of members sick in a year among 100 members exposed to risk; first, for the whole society; second, for the agricultural and general section; third, for mining; and fourth, the actual excess of sickness among miners over the agricultural and general labor classes.

This table shows that at ages from 16 to 19 inclusive, among equal numbers there will be, in round figures, 26 weeks of sickness per annum among 100 members of the agricultural and general labor classes, against 41½ weeks of sick-

ness in this report are some very interesting and important observations upon the experience of the mining lodges which foreshadow financial disaster to many of them unless radical measures are adopted to bring about the necessary degree of actuarial solvency.

Even at the present rates, which have been demonstrated to be altogether insufficient, it has been found impossible to carry forward the work of some of the mining societies, which are, therefore, gradually losing in membership and which no doubt in course of time will be dissolved. The qualified advice which has been given to most of the societies by the actuaries of the order has been almost universally rejected in much the same manner as fraternal societies in the United States continue to operate upon erroneous or inadequate tables of mor-

<sup>1</sup>An account of the investigation of the sickness and mortality experience of the I. O. O. F. Manchester Unity during the five years 1893-97, by Alfred W. Watson, F. I. A., F. S. S. London: Charles and Edwin Layton, 1903.

\*Statistician, Prudential Insurance Company, Newark, N. J.

ciety have to say that, "while the present hazardous occupation tables do not provide for anything approaching the claims of the present day, we believe that they would approximate to sufficiency for mining lodges if the accident benefit were eliminated."

#### MUST CONSIDER ABNORMAL ACCIDENT LIABILITY OF MINERS

They state further: "We do not think, however, that they would be found more than necessary in those circumstances. It must not be supposed that the liability in respect of a miner, iron smelter, chemical worker, or railwayman is equivalent to that in respect of an agricultural laborer, a clerk, or a tradesman, so soon as the occupational accident benefit is abolished. Such occupations as those first named are followed under exacting conditions as to physical fitness, and ailments which in the case of members following light occupations would be regarded as unimportant, will operate as effectually as a serious illness in keeping

New South Wales in 1904, 10,648 were gold miners, 7071 were silver and lead miners, 2745 were tin miners, 1850 were copper miners, 14,146 were coal and shale miners, and 1377 were miners of miscellaneous minerals. Only a portion of these miners are, of course, members of registered friendly societies included within the valuation for the period previously referred to. It is further to be taken into consideration that the rate of mortality of friendly societies' members in New South Wales is quite favorable during the entire working period of life; and the same is true of the morbidity, which has even been below that for the corresponding period in New Zealand, which is one of the most healthful countries in the world.

#### SICKNESS RATE IN NEW SOUTH WALES

Referring to hazardous occupations, however, it is pointed out that "the only well defined class of occupations carrying a heavy sickness risk, the experience of whose members is readily deduc-

port as follows: "The fourth column of Table IX shows for each age group the advance in rate of the mining section over the non-mining section; and viewing the effect of the sickness of mining members as a whole, we arrive at the conclusion that, unit for unit of membership, a miner causes 39 per cent. more expenditure for sick pay than a non-miner. This, in effect, means a sickness cost of 27s. 10d. for every £1 (\$6.77 against \$4.86), as between the miner and the non-miner, and clearly proves that the extra risk incurred in accepting a miner into membership justifies a very appreciable loading up of his periodic contributions in respect of his sickness benefit."

#### PERCENTAGE OF SICKNESS FOR MINERS ABOVE NORMAL

Even more significant are the results for particular lodges with a considerable membership of miners. Thus, in the experience of the Grand United Order of Oddfellows, Friendly Society of New South Wales, the excess in the sickness of miners over non-miners was 50 per cent. for all ages, and as high as 88 per cent at ages from 61 to 65, and 157 per cent. at ages 66 to 70 inclusive. While the actual sickness of non-mining members was only 74 per cent. of the expected, the actual sickness of mining members was 111 per cent. The result of this experience may be summarized in the statement that where a week's sickness is suffered by an ordinary member, a miner, on the average, suffers invalidity or incapacity for work for a period of 10 days.

#### EXPERIENCE OF NEW SOUTH WALES I.O.O.F.

Almost identical has been the experience of the Independent Order of Oddfellows, of New South Wales, and in commenting upon the results of the sickness investigation, it is pointed out that:

"A clear idea of the contrast between the two classes is gained when we express the mining rate in terms of the non-mining rate . . . from which it appears that the miners' sickness is higher by 9 to 67 per cent. in the several ages than that of non-miners; or in other words, the miners suffer an intensity of sickness rising as high as two-thirds above that of the non-miners. The isolated case in the table where the miners show a lower rate, viz., in age group 36-40, serves only to accentuate the facts to which I call attention. It must, therefore, be obvious that the presence of the mining class in any considerable proportion on the rolls of a friendly society will have an adverse effect, to a pronounced degree, on the sick list, and consequently upon the resources of the society, and will greatly increase the difficulty of attaining and retaining a solvent condition. As a rough example of this effect, if the miners' sickness on the whole be one-

TABLE IX. COMPARATIVE MORBIDITY OF MINING AND NON-MINING MEMBERS OF FRIENDLY SOCIETIES IN NEW SOUTH WALES, 1900-04.

Age-group.	ACTUAL SICKNESS PER CENT. OF EXPECTED.			Mining Rate Per Cent. of Non-mining Rate.
	All Members.	Non-mining Members.	Mining Members.	
16-20	153	138	196	142
21-25	100	96	126	131
26-30	85	82	105	128
31-35	81	78	103	132
36-40	82	79	102	129
41-45	84	80	112	140
46-50	81	76	112	147
51-55	83	79	110	139
56-60	98	94	125	133
All ages	88	83	114	139

say a miner or railway engine driver from his accustomed work. The calling of a miner, apart from the accident risk, may be as healthy as that of an agricultural laborer from a medical point of view, but emphatically it is not so as regards the risk of inability to follow his customary occupation; much misunderstanding will be avoided if this be kept constantly in view."

#### EXCESSIVE DISEASE LIABILITY OF MINERS

It may seriously be questioned whether even from a medical point of view, under the most favorable conditions, the calling of a miner can ever be as healthful as that of an agricultural laborer living under similar social and sanitary conditions. All of the really trustworthy evidence on the subject is entirely conclusive that the calling of a miner, aside from the accident risk, is more or less detrimental to health, and this view is fully sustained by the first valuation of the friendly societies of the State of New South Wales for the period 1900-04.

Since the disease liability of miners varies with the mineral or metal mined, it requires to be taken into consideration that of the 37,837 miners employed in

able, is that of the mining section of the community." This statement is fully sustained by Table IX, which exhibits the actual sickness per cent. expected; first, for all members; second, for non-mining members; third, for mining members; and fourth, the excess per cent. of the mining rate over the non-mining rate.

It is brought out by this comparison that at all ages 16-60, the sickness rate among the mining members in New South Wales exceeded the sickness rate of non-mining members by 39 per cent. The rate was highest at ages 46-50, but the numbers are probably too small to warrant entirely safe conclusions for specific periods of life. It is to be observed that while the sickness rate of non-mining members was in excess of the expected only at the youngest age period, 16-20, the sickness rate for mining members was in excess of the expected at every period of life. This experience for New South Wales thus fully confirms the corresponding experience for the Manchester Unity of England.

The serious significance of these differences from a financial point of view in the safe administration of miners' insurance funds is precisely stated in the re-



third more than that of non-miners, then we find that a society consisting entirely of miners, say 3000 strong in membership, would incur the same cost per annum for sick pay which a society of non-miners 4000 strong would have to meet during the same time, although, on the average, it would only receive three-quarters of the amount of revenue receivable by the second society. Comment on such a position is quite unnecessary."

#### PROPOSAL TO REFUSE MINING CLAIMS

The foregoing experience was further confirmed by that of the Independent Order of Rechabites. In the experience of this order, "in every age group the mining rate is in glaring contrast to the non-mining rate," and the range in the excess in the amount of sickness was from 21 to 76 per cent.; or, in other words, the miners suffered approximately from one-quarter to three-quarters as much sickness as the non-mining classes. As the result of this experience, it was suggested that the society should refuse to entertain claims for sick pay arising out of accidents in a mining occupation—a proposition considered to be feasible on account of the institution of the Miners' Accident Relief Fund in New South Wales.

#### ALL DATA POINT TO SAME CONCLUSION

Without enlarging too much upon the details of the New South Wales sickness experience, the following reference to the experience of the Manchester Unity, Independent Order of Oddfellows Friendly Society, in New South Wales, is included as particularly significant and quite conclusive to sustain the point of view that every qualified investigation into the facts sustains the conclusion that miners as a class are decidedly subject to a higher sickness rate, whether arising out of sickness *per se*, or as the result of accident, than the non-mining class. It is pointed out in connection with this experience, which has particular reference to the Newcastle and Barrier districts, that the mining membership of the society included 11.25 per cent. of the total membership; and the tabular analysis of the experience shows a decided excess in the amount of sickness among miners over the corresponding amount of sickness among the non-mining members.

#### OPINION OF SOCIETY

Upon the basis of this experience, it is held that:

"The figures thus shown cannot be ignored, but on the contrary, demand the deepest reflection as to their import. The high rate of sickness already noticed in the ages below 25 and in age-group 56-60, when we were discussing the society as a whole, appears again for both miners and non-miners; but, while with non-miners every other age of life shows an experience considerably below standard,

ranging down to 30 per cent. lower at ages 46-50, an emphatic contrast appears in all ages of the mining members. To get a clear idea of what this contrast means we must express the mining rate in terms of the non-mining rate, as shown in the last column of Table IX, from which it appears that the miners' sickness is high by 21 to 76 per cent. in the several ages than that of non-miners; or, in other words, the miners suffer approximately from one-quarter to three-quarters as much again as do the non-mining classes. What these enhanced rates would mean if the mining class were to become a considerable proportion of the membership of the society may be gathered when I mention that the bulk effect of a mining membership as against a non-mining membership in the society, as at present constituted, would mean an increase in the total sickness by at least 36 per cent. At the present time the society pays, at a rough estimate, for nearly 1600 weeks sickness per annum more than it would if there were no miners in its membership. This represents an additional half-day's illness per head in the whole society, and manifestly is the cause of an appreciable addition to the cost of sickness. It is obvious, therefore, that if these lodges, consisting in whole or in part of the mining classes, are to be carried on as separate concerns in respect of sickness as heretofore, then considerable modifications must be made for their satisfactory working."

#### UNFAVORABLE EXPERIENCE AGAIN CONFIRMED

Almost identical conclusions are arrived at upon the basis of the experience of the Protestant Alliance Friendly Society of Australasia, Grand Council of New South Wales, as follows: "The exposures to sickness risk, as seen in the quinquennial tabulations, show that the mining element is only about 9 per cent. of the total membership, and the extra strain on the resources of the society arising from this section is not yet severely felt. It is, however, obvious as the results of my researches in the affairs of other societies, recently valued, that the presence of the mining class in any considerable proportion on the rolls of a friendly society will have an adverse effect, to a pronounced degree, on the sick list, and consequently upon the resources of the society; and will greatly increase the difficulty of attaining and retaining a solvent condition."

#### CONCLUSIONS DOUBTLESS APPLY TO UNITED STATES

Since the excess in sickness rates is, to a considerable extent, the result of accidents, it may be stated in this connection that the average fatal accident rate for coal miners in New South Wales was 2.01 per 1000, against 3.33 per 1000 em-

ployed in the coalfields of North America during the decade 1898-1907. The non-fatal accident rate is of doubtful value, but it is safe to assume that the rate would also be higher for this country than for New South Wales. The average fatal accident rate for metal mining in New South Wales during 1903-07 was 1.10 per 1000, against 2.86 for the United States, and the same conclusion applies with regard to the non-fatal accident rate in this branch of the industry, which is unquestionably somewhat higher than the corresponding rate for New South Wales. It is, therefore, a valid assumption that the morbidity of miners in this country is as a matter of practical certainty considerably in excess of the corresponding morbidity of the non-mining population, and that the results of qualified inquiries into the subject abroad require similar investigations to be made in the United States.

#### MINERS' ACCIDENT RELIEF FUND

Finally as a further contribution toward a better knowledge of the whole question of miners' accident and disease liability, and effective measures and means to mitigate the disasters resulting from a recognized dangerous trade, the following account of the Miners' Accident Relief Fund as extracted from the *Official Year Book*, of New South Wales for 1907-08 is appended as an illustration of what is probably the most interesting and promising effort which has thus far been made to ameliorate the condition of a class which by every humanitarian consideration is entitled to the highest degree of solicitude on the part of government and the people at large:

"The New South Wales Miners' Accident Relief Act, which came into force on January 1, 1901, applies to all mines in or about which 15 or more persons are employed. A sum of 4½d. (9c.) per week is deducted from the wages of each employee and paid by the manager of the mine to the treasurer of a committee for the mine. The committee for a mine consists of: (1) An Inspector of Mines appointed by the Minister; (2) Three persons appointed by the employees, and; (3) Two persons appointed by the owner or manager, if he thinks fit. The committee receives and considers all applications for relief in cases of accident, and votes such allowances as appear warranted under the provisions of the act. The fund is administered by a board consisting of six members, one of whom is the chairman, and the others representative of: (1) Owners of coal and shale mines; (2) Owners of other mines; (3) Persons employed in or about coal and shale mines; (4) Persons employed in or about other mines, and; (5) The Department of Mines. Payments into the fund consist of: (1) The balances of deductions from wages unexpended by the committees in payment of allowances; (2) A

quarterly contribution by the owner or owners of each mine equal to 50 per cent. of the aggregate amount deducted from the wages at such mine, and; (3) A subsidy from the Consolidated Revenue Fund equal to the amount contributed by owners of mines. The board makes advances to committees in cases where the sums deducted from wages are inadequate to meet allowances payable.

#### BENEFITS INCREASED

"The benefits provided by the act were increased in 1905 after an actuarial valuation of the fund, and those now payable are:

(1) In cases of fatal accident—(1) Funeral allowance, £12 (\$58.32); (2) A weekly allowance of 10s. (\$2.45) to the widow or other adult dependent upon the deceased for support, and; (3) A weekly allowance of 3s. (\$0.72) in respect of each child of the deceased or of each

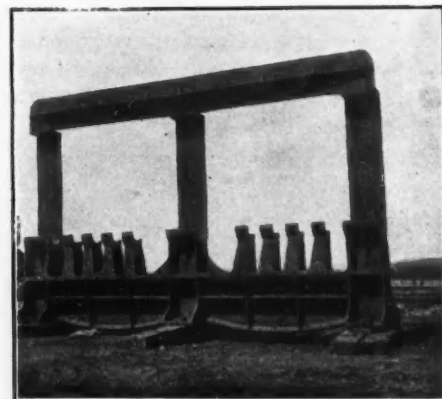
of whom 678 were drawing allowances in respect of fatal accidents, and 198 as the result of permanent disablement; 261 persons were drawing an allowance of 10s. weekly, and 92 permanently disabled workmen were each receiving 15s. weekly. The balance was made up of 523 children, to whom a weekly allowance of 3s. was made, 417 of them being beneficiaries in respect of fatal accidents."

### The City Deep Mill

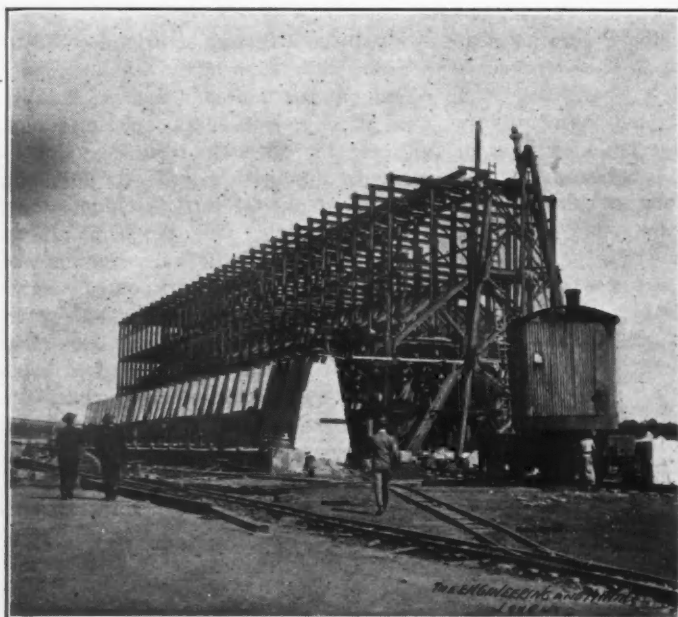
By E. M. WESTON\*

Through the courtesy of J. Whitford, manager of the City Deep mill, the accompanying views of the mill in course of erection are available for publication. The mill embodies the latest constructional ideas of Eckstein & Co.'s engineer, Mr. Robeson, and his assistant, Mr.

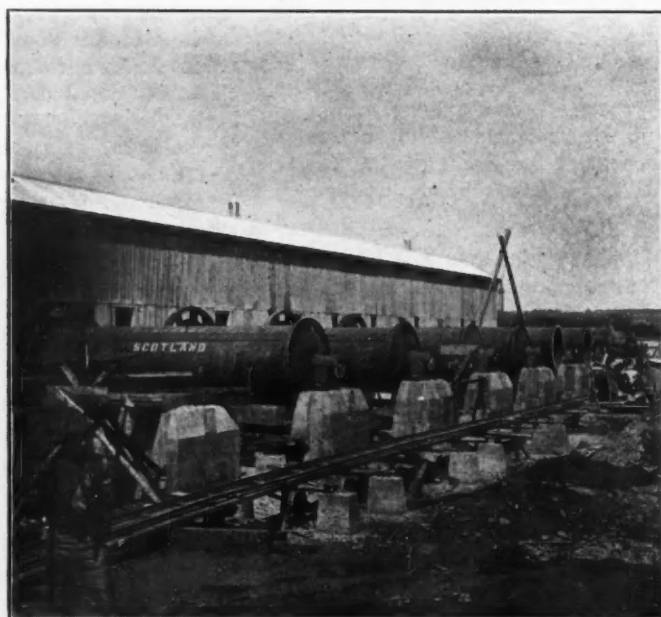
are used to draw 30-ton trucks up a gentle grade to the top of the bins. The embankment required is an extensive one, being about one mile long, rising to over 40 ft. in height and with equipment it will cost £55,000; but as the mill may



CASTING FOR CITY DEEP BATTERY



CONCRETE STAMP FOUNDATION AND STEEL BINS FOR CITY DEEP MILL



TUBE MILLS FOR USE ON THE WITWATERSRAND AT THE CITY DEEP MILL

child of an adult dependent, payable until such child attains the age of 14 years.

(II) In cases of disablement—(1) A weekly allowance of 15s. (\$3.64) until able to resume work, and; (2) Where disablement is permanent, a weekly allowance of 3s. (\$0.72) in respect of each child under the age of 14 years.

For the eight years during which the act has been in operation the average annual number of employees contributing has been 23,941, the amount contributed being £186,744. During the same period the mine owners have paid £88,836, and government subsidy to the extent of £88,836, and interest amounting to £27,835, have been received; the sum of £161,413 has been disbursed in allowances. Accumulated funds, amounting to £220,000, have been invested in New South Wales funded stock. At the end of 1908, the "permanent" beneficiaries numbered 876,

Laschinger. It will consist of 200 stamps each weighing 2000 lb., set back to back, and on a duty of 11 tons per stamp is estimated to crush 65,000 tons per month. It is probable, however, that a duty of twice that amount will be obtained, as there are eight tube mills, or one to 25 stamps instead of one to 50, as in most other mills.

One photo shows the steel bins designed to hold 4750 tons of rock. They are 196 ft. long, 25 ft. 6 in. wide, and 42 ft. high. The members of the frame were put together and hoisted into position in six-ton sections. The steam derrick is shown erecting a steel girder to support the rail line which comes from a high embankment not shown. The arrangement is similar to that in the Simmer Deep mill, but electric locomotives

\*Mining engineer, St. Mary's buildings, Johannesburg, Transvaal.

crush from 30,000,000 to 60,000,000 tons the capital outlay is justified. The battery posts are of reinforced concrete, 7 ft. high, 4 ft. x 14 in. on the top. On these rest 12x14x48-in. timbers, and on these is placed the large casting shown in the illustration. It is held down by six 1 3/4-in. bolts. The casting supports the cam shaft along its whole length between the cams. All amalgamation is done on 72 shaking tables, placed below the tube mills. Reinforced concrete is employed everywhere for foundation pillars and girders, for large rectangular solution tanks, floors and walls.

The Bunker Hill & Sullivan company has donated \$30,000 for a Y. M. C. A. building at Kellogg, Idaho, for the miners. Work on the building has commenced.

### A Standard Series of Screens for Laboratory Testing\*

BY THEODORE J. HOOVER†

The suggestions here made are an attempt to reconcile the conflicting elements in former suggestions, and at the same time to present a system which has merits hitherto wanting; also to present a practical mechanical method of making screen analyses. There are two phases to the problem: (1) The measurement of the result of crushing different ores in the same machine. (2) The measurement of the result of crushing the same ore in different machines, or with different adjustments or combinations of the same machine.

There are two methods of manipulating a sample in the laboratory in order to determine some of these points. (1) A

#### RICHARDS' SERIES

Richards proposed a geometric series in which the ratio between the sizes of apertures was the  $\sqrt[3]{2}$  and his first term was 1 mm. This series cannot be objected to on the ground of lack of terms, inasmuch as there are 14 or 15 screens between the necessary limits. The series errs on the side of too great abundance in this regard. It is also based on the metric unit of measurement, with no simple relationship to the English unit of an inch.

#### DE KALB'S AND THE I. M. M. SERIES

De Kalb proposed an arithmetic series, chiefly objectionable for its lack of screens within desirable limits, there being but six or seven available in the lower range. The series also disappears too soon in the lower limit. The series has in it a unique relationship expressed as a second dif-

1 in. by the  $\sqrt[3]{2}$ ; this gives us our second aperture. Dividing the second aperture by the  $\sqrt[3]{2}$  we get the third aperture, and so on down to the 28th term of the series, where we reach the limit, roughly 250 mesh, of effective screening. The decimals in this series were calculated accurately to five places, and when the 15th term of the series was reached, it came to 0.03937 in., which decimal will be recognized as the legal British and American equivalent for one millimeter.

Here, then, is a series which may start from either 1 in. or 1 mm. and, by varying the successive apertures so that they are in ratio of  $1 : \sqrt[3]{2}$ , get a series of screens which obviates this and all other objections urged. The English and metric units of measurements are here brought into a semblance of harmony. This harmony can be expressed by the proportion:

$$1 \text{ in.} : 1 \text{ mm.} :: 1 : (\sqrt[3]{2})^{14}.$$

The  $\sqrt[3]{2}$  being also the common multiple of the series. In this connection it is of interest that

$$(\sqrt[3]{2})^{14} = 25.3995$$

which is the factor we are accustomed to use in reducing inches to millimeters (as 1 in. = 25.3995 mm.). It should be pointed out, however, that the above proportion is true only to the fourth place of decimals.

This series of screens can be secured approximately from the stock sizes of screen cloth made by most manufacturers to a near enough degree of accuracy. How close this approximation is, may be observed in the accompanying table, showing stock sizes of American and English screens.

#### HAND VS. MECHANICAL SIZING

The time required to make a dry sizing test by hand on one kilogram of ore with a cube-root series of screens, is about 10 hours. The actual sizing could be done wet in about six hours, but the drying of the small sizes would take as much more time. In lieu of this antiquated and laborious method, I have devised a machine which will accomplish the whole sizing operation on the above series in less than 20 minutes.

The quality of the work done on this machine is superior to any hand test, either wet or dry; and by adopting a fixed number of minutes, the results of a series of screening tests can be compared with confidence, because the coefficient of laziness is entirely eliminated. Twenty minutes is about the proper length of time for the actual sizing operation. With this machine equipped with screens which have been selected with reference to some desirable series in the dimensions of the aperture, tests can be made which can be as safely compared as are the results from different assayers.

COMPARISON OF ENGLISH AND AMERICAN STOCK SIZES OF SCREEN CLOTH.

CUBE ROOT SERIES.	POTTER'S STOCK, London.			TYLER'S STOCK, Cleveland, Ohio.		
	Aperture, Inches.	Size of Wire, Inches.	Mesher per Inch.	Aperture, Inches.	Size of Wire, Inches.	Mesher per Inch.
0.1250	0.1270	0.04	6	0.1270	0.04	6
0.0992	0.0990	0.026	8	0.1000	0.025	8
0.0787	0.0790	0.021	10	0.0770	0.023	10
0.0625	0.0630	0.020	12	0.0630	0.0205	12
0.0496	0.0490	0.022	14	0.0488	0.01375	16
0.0394	0.0407	0.0148	18	0.0397	0.01025	20
0.0313	0.0318	0.0316	22	0.0314	0.01025	24
0.0248	0.0241	0.0116	28	0.0247	0.01375	26
0.0197	0.0193	0.0092	35	0.0195	0.01375	30
0.0156	0.0156	0.0090	40	0.0155	0.0095	40
0.0124	0.0124	0.0076	50	0.0125	0.0075	50
0.0098	0.0099	0.0068	60	0.0098	0.01025	50
0.0078	0.0075	0.0050	80	0.0077	0.0065	70
0.0062	0.0063	0.0048	90	0.0061	0.0050	90
0.0049	0.0047	0.0036	120	0.0050	0.0040	110
0.0039	0.0035	0.0020	180	0.0039	0.0032	140
0.0031	0.0034	0.0016	200	0.0031	0.0024	180
0.0025	0.0028	0.0014	250	0.0030	0.002	200

sample may be classified in an ascending current of water and determinations made as to the composition of the various products secured according to two variables, weight and size. (2) A sizing test on a series of screens divides a sample into products according to the one variable, size.

#### RITTINGER'S SERIES

Rittinger proposed a geometric series in which the ratio between the sizes of the apertures in successive screens was  $\sqrt{2}$ , and his first term was 1 mm. His series can be extended upward from 1 mm. for purposes of comparison with the other series here mentioned. The same objections can be raised to this series as to the "common series" in which the ratio is 2. There are not enough screens within the limits of 25 and 250 mesh. Another objection to the series is that it is based on the metric unit of measurement with no simple relationship to the English inch.

\*Excerpts from a paper read at the May meeting of the Institution of Mining and Metallurgy, London.

†Consulting engineer, Minerals Separation, Ltd., London, England.

ferential, but either Rittinger's or Richards' series of screens is better for laboratory testing purposes.

The committee on standardization of the Institution of Mining and Metallurgy in 1907 adopted a standard series of screens for laboratory testing. The main idea in the series was to have the screens manufactured so as to be perfectly locked, with 25 per cent. screen aperture, in order to prevent shifting of the wires with use. There is no simple way to express the relationship in this series. The only simple law adhered to is that the series is arranged in the order of meshes per inch, and that each succeeding screen has an aperture smaller than the preceding one. The I. M. M. standard is not a regular series.

#### CUBE ROOT SERIES

A geometric series of diameters of apertures for a set of screens for laboratory testing is now proposed.<sup>1</sup> We will start with an aperture of 1 in., and divide

<sup>1</sup>This series was mentioned by Robert H. Richards in a paper read before the American Institute of Mining Engineers, but he does not advise its use.

# Electricity in West Virginia Mines

One Electric Locomotive Will Do Work of 15 Horses. Hoisting Drums Operated by Direct-current Motors, and Electrically Driven Fans, Used

BY R. NEIL WILLIAMS

The causes which have led to the general adoption of electricity as a motive power in mining work are mostly obvious. The only logical competitor of electricity is gravity, which is, of course, the cheapest power as long as its use does not involve too much loss of time, or its inflexibility necessitate an expenditure for labor of a sum sufficiently great to offset the saving in investment and that effected by the elimination of the fuel bill. Where conditions do not permit of mak-

The economic advantage of electric operation becomes evident from an inspection of the pay roll, for with electric locomotives longer trips can be made at higher rates of speed, with the result that one locomotive will do the work of fifteen horses on the average. This means the employment of one good man instead of fifteen boys, and the expenditure of \$2.50 to \$3 for power instead of \$7.50 for feed.

The advantages of electricity as a

Railroad, which begins just above Piedmont, W. Va., at the junction of this railroad and the B. & O. In the Fairmont region, the company also owns 30,000 acres of coal lands, which, however, are not being worked.

It is interesting to follow the development of this company through the various stages of its growth and to note how systematically the various managements have worked to a well thought out plan of electric operation. While the use of



GENERAL VIEW OF THE THOMAS POWER PLANT AND TIPPLES BELONGING TO THE DAVIS COAL AND COKE COMPANY

ing use of gravity, either horses, mules or electric locomotives must be employed; advantages being much in favor of the latter, especially when the thinner seams of coal are exploited. The horse as a factor in coal-mining became of minor importance with the advent of electric haulage in 1887. The mortality of horses used in mining work is extremely high, while the first mining locomotive built in the United States, for the Lykens Valley Coal Company, is still hauling coal in everyday service. This feature is accentuated by the necessity of using very small horses in mining work and of their working in the dark and in bad air.

source of power in coal mines where the electric installation has been properly made and is wisely managed are exemplified in the equipment of the Davis Coal and Coke Company, which operates bituminous mines in West Virginia along the lines of the Western Maryland Railroad Company. At the present time this company owns 160,000 acres of coal land and operates mines at West Virginia Central Junction, Elk Garden, Harrison (Harrison being included in the Elk Garden district), Henry, Thomas, Coketon and Weaver; these places being situated, in the order named, along the West Virginia C. & P. Division of the Western Maryland

electric power in the first place was made imperative by the nature of the working, its advantages in other directions than those which compelled its adoption became apparent and led to the introduction of electricity for other purposes.

#### DECIDED TO USE ALTERNATING CURRENT

Realizing that the distances over which it would be necessary to transmit electrical energy were, in many cases, already too great for the economical use of direct current, and that as the operation in the mines extended, all these distances must necessarily become greater, it was decided to use alternating cur-

rent wherever possible. The greater economy of alternating current for long distance transmission was not, however, the only consideration which was influential in the adoption of this policy. The alternating current system is very much more flexible than any direct-current system, and is adapted readily to any distance of transmission by means of the simple alternating current transformer. Furthermore, the induction motor is admirably suited for use in coal mines, particularly for driving pumps and fans which run continuously. As it requires no brushes or other devices for making electrical connection with the secondary circuit, the rotor revolves very freely and there is no friction other than that of the bearings. This arrangement requires a minimum of attention and insures absolutely no sparking. A motor of this type will operate for long periods of time with

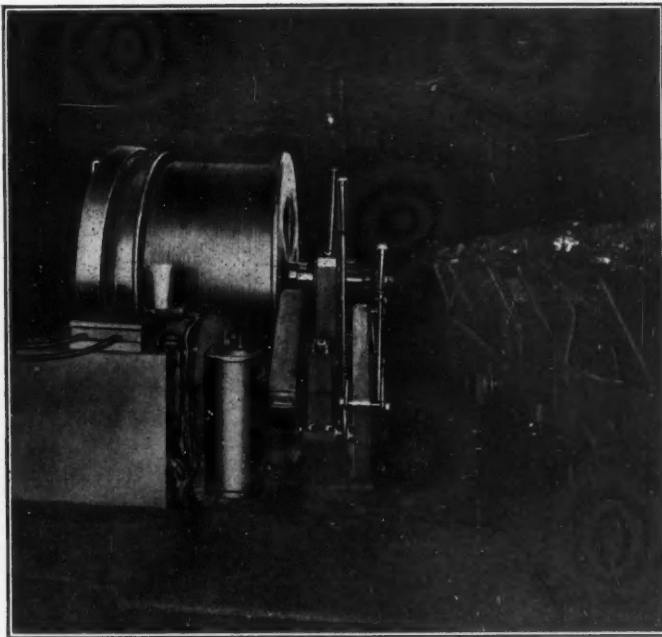
due to the slowness of the drivers in getting back into the workings.

#### ELECTRICAL DEVELOPMENT HAS BEEN CONSISTENTLY CARRIED OUT

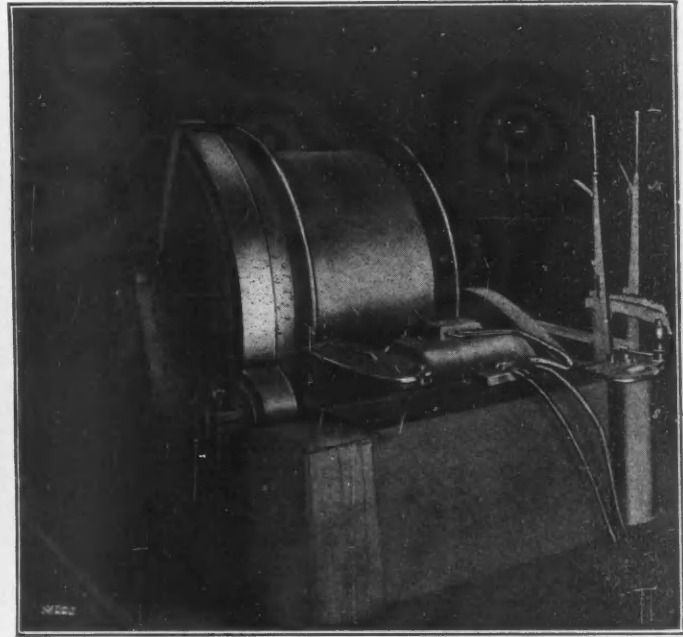
The electrical development has been consistently carried out throughout all of the various workings with 600 volts direct current for haulage and three-phase alternating current, at a frequency of 60 cycles, for all other purposes, with the exception of the lighting of the various mining towns. For this purpose, single-phase alternating current is used, constant current tub transformers being employed for the lighting of streets.

This policy of buying uniform apparatus for all mines, even to standardizing the make of machinery, has resulted in an almost entire absence of an electrical junk pile. It is a case of the pitcher going to the well till it is broken, and

amply large for the duty. Stinting in this respect would be poor policy, but naturally the result of having partially loaded motors continuously in operation results in a very poor power factor for the whole system. The main objection to low-power factor in mining work is not the necessity of providing transmission lines large enough to carry the excess idle current, but chiefly one of station economy. A unit consisting of steam driver and electric generator designed to deliver an output of, say, 100 kw. at 100 per cent. power factor can only be called on for 55 kw. at 55 per cent. power factor, and not even for this unless the fields and armature have been specially designed for such operation. Even assuming this to be the case, the steam end of the unit would be operating at but little more than half load, and consequently with very poor efficiency. It is, therefore, desir-



THE DIRECT-CURRENT SERIES MOTOR WAS ADOPTED FOR HOISTING.



HOISTING DRUM OPERATED BY DIRECT-CURRENT MOTOR

no further attention than an occasional inspection of the oil gages and air gap.

#### DIRECT CURRENT SERIES MOTOR ADOPTED

For haulage and hoisting purposes, the direct-current series motor was adopted, due to its characteristic of maximum torque at starting. Owing to the long distances to which direct current had to be transmitted, it was decided to generate it at a potential of 600 volts. The objection which might be raised to this high potential, due to the danger to men and animals, where the latter are still used for gathering, is more imaginary than real, owing to the fact that the current is turned off while the shifts are changing. In fact, there has been no loss of human life from electric shocks in the company's entire history, and only a few instances in which animals have come into contact with live wires and were electrocuted. In these cases, the accident was

but for the advent of greatly improved steam motive power in the form of the Curtis steam turbine, there would have been very little noticeable depreciation in any of the apparatus. As it is, the increase of power required by the rapid developments in the last year or two has made it necessary to operate the older reciprocating steam units in multiple with the steam turbines; but it is hoped that in a short time it will be possible to discontinue some of the less efficient steam engines and use the corresponding alternating current generators as synchronous condensers to improve the power factor of the general system.

#### THE MAIN OBJECTION TO LOW POWER FACTOR

The importance of the work being done by the induction motors in mine ventilation and pumping is so great that these motors must of necessity be selected

able to bring up the general power factor as near as possible to 100 per cent. by means of units independent of the generators. Rotary condensers, or synchronous motors, operating as motors, are suitable for this purpose, whether running idle or with load. It is not always possible to provide a suitable load for a synchronous motor in the interior of the mine itself, as this type of machine will not operate with the small amount of attention required by an induction motor, and is more susceptible to fluctuations in the supply of electric energy. However, there is no reason why fans outside the mines and not too far from the power station or repair shops, where expert attention is available, should not be driven by synchronous motors. If the motor runs idle, the improvement in power factor is gained at the expense of an amount of energy representing the losses in the motor.

In the following history of the Davis

Coal and Coke Company and its development, the electrical equipment will be discussed in conjunction with the description of the various workings.

#### HISTORY OF DAVIS COAL AND COKE COMPANY

In 1884 some prospectors in the employ of H. G. Davis & Bro. discovered the Davis vein of coal near Thomas, W. Va. This was the beginning of the present company and of operations at Thomas. In 1886 H. G. Davis & Bro. and S. B. Elkins formed a partnership for the purpose of opening the Davis coal at a point about a mile south of Thomas, at what is now known as Coketon, W. Va. In 1887 the first coke ovens were built and experiments made as to the coking qualities of the coal, which was found to be indeed an excellent coking, steaming and smelting product. In 1888 the Davis Coal and Coke Company was incorporated with an authorized capital stock of \$250,000, which in 1893 was increased to \$3,000,000 to enable the company to acquire controlling interests in several other mines operating on the line of the W. Va. Central Railway. From this time on, until the taking over of the road by the Goulds as the coal-operating department of the Western Maryland, the development of the company from a technical point of view has been systematic and comprehensive.

Taking the various operations in geographical rather than historical order, we will begin with the mines nearest to Tidewater. At West Virginia Central Junction there are four operations, two in what is known as the Bayard formation, which carries the Bakerton seam of coal and is locally known as the "four foot;" and the "three foot" coal, operated elsewhere as the upper Freeport seam. These mines are operated by the General Electric system of rope haulage. As the mines are on the extreme eastern outcrop, the pitches are very heavy and haulages are located at the extreme end of the headings on the inside of the mines. Empties are hauled in with the rope and the loaded cars dropped out by gravity, dragging the rope behind them. The loaded cars are controlled by brakes on the hoisting drums, which are operated by 550-volt direct-current motors.

The Bakerton seam is at the very top of the Bayard formation and, since the north branch of the Potomac river cuts the valley deep at this point, the above two mines are opened very high on the hillside and require inclined planes 2100 ft. in length to reach the railroad track. Mine No. 19 is operated at the base of these planes, on the lower Kittanning seam, known locally as the "six foot." This mine also requires rope haulage, which is placed on the inside of the mine as in the case of the two mines above referred to, Nos. 50 and 51. The power station for this group is equipped with

a 150-kw. General Electric generator driven by a Buckeye engine. These three mines, together with number 17 on the opposite side of the river in Maryland, which uses endless-rope haulage, constitute the West Virginia Central Division, under the direction of O. Tibbets, superintendent.

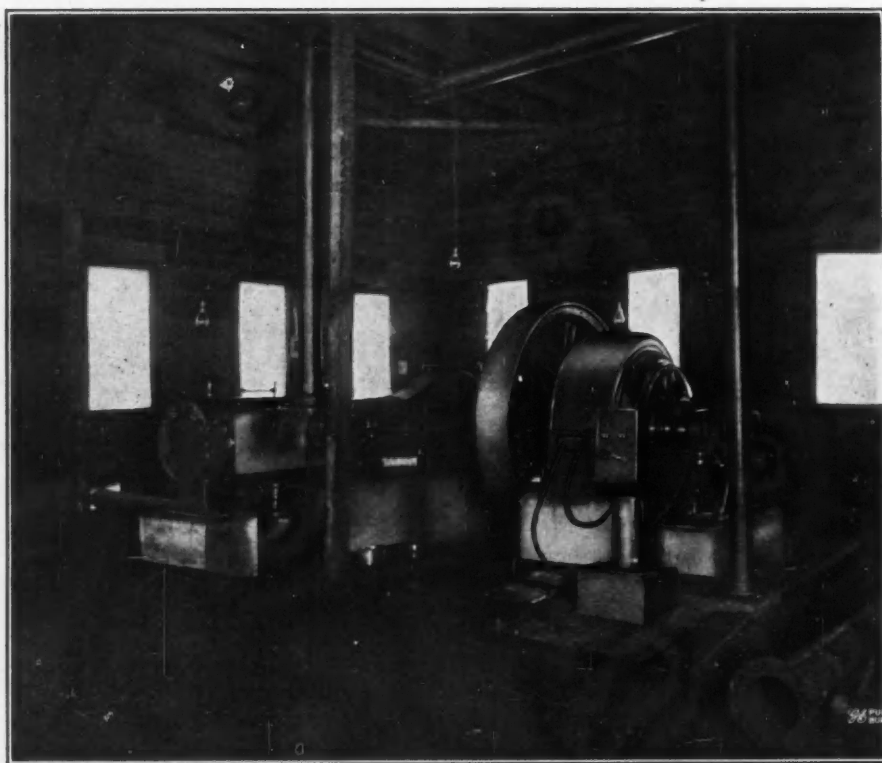
#### THE MINES LOCATED AT ELK GARDEN

The next group of mines, located at Elk Garden, are principally in the Pittsburg formation. These mines are Nos. 6 and 9 in the Pittsburg formation; No. 10 in the upper Sewickly, which is known locally as gas coal; No. 20 in the upper Freeport seam on a line with the railroad; and No. 14 four miles west of No. 20 on Abrams creek, producing a very

mine are of brick. The plant is equipped with electric haulage throughout and the coal is mined with compressed-air punching machines.

#### MODERN EQUIPMENT IN THE POWER HOUSE AT HENRY

The power house contains two 24x26x30-in. Ingersoll air compressors, one belted 150-kw. alternating-current generator, one 250-kw., 600-volt, direct-current, generator for haulage purposes, and a synchronous motor direct-current generator set, which acts as connecting link between the two generating units, permitting either one or the other to be shut down. This set can be operated from either end so as to provide direct or alternating current. On the main



SHOWING 150-Kw., 600-VOLT, ENGINE-DRIVEN DIRECT-CURRENT GENERATOR

high-grade coal. With the exception of No. 6, which has a gravity rope haulage, this group is not provided with mechanical haulage other than steam trams. Robert Grant is superintendent of the Elk Garden district, with headquarters at Elk Garden.

At Henry, about 8 miles east of Thomas, is located one of the later and, consequently, one of the more modern of the company's operations. The complete Bayard and Savage formations are accessible from this plant, the upper Freeport and the lower Kittanning being in good workable condition. It is operated by shafts 1 and 2 tapping the upper Freeport at a depth of 250 ft. and the lower Kittanning at 450 ft. Tipples and hoisting towers are built of steel, while the power house, engine houses, blacksmith shop and all buildings in connection with the

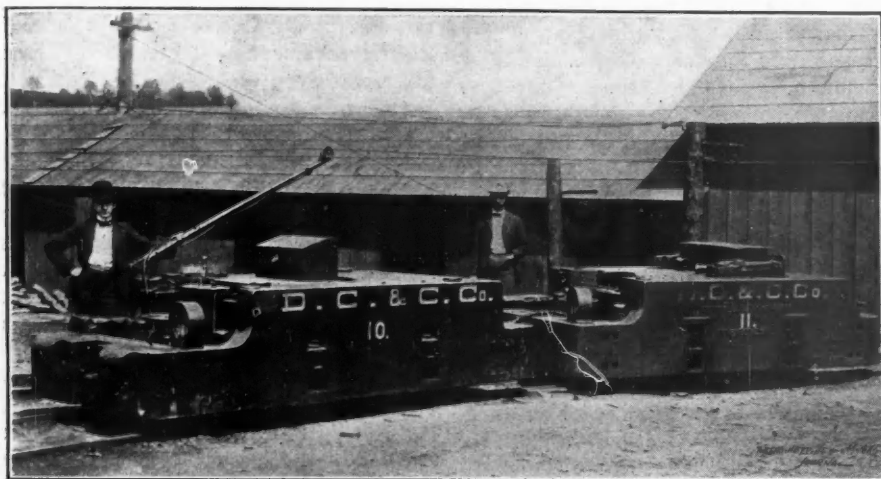
roads of this mine, the hauling is done with one 13-ton and one 10-ton locomotive (the latter of general electric manufacture), while the coal is gathered with two General Electric gathering locomotives of 4½ tons each. In portions of the mine the coal is still gathered by mule haulage. W. J. Christopher is superintendent of this division.

The next operation is at Thomas, where the upper Freeport coal is mined by drift mines at tippel height above the railroad. No. 23 mine has been operated for a number of years and has become quite extensive in its workings; it is, however, still a good mine, producing 1200 tons of coal per day from a seam 8½ ft. thick, and is free from any noxious gases. Mine No. 25 is directly opposite mine No. 23, with a drift opening slightly to the dip in the same seam of coal. Mine No. 24

is in this same group, and is worked from a shaft 200 ft. deep penetrating to the Davis seam of lower Kittanning. The seam is divided horizontally by a rock, the portion above the rock being 8 ft. thick and that below 3 ft. thick. The rock serves the purpose of a pavement and, therefore, the coal below it is not worked to any extent in this mine. The coal is of an exceptionally good quality, running less than 1 per cent. in sulphur and seldom over 6 per cent. in ash, making No. 1 coke equal to the Connellsville. This group of mines is operated entirely by electric haulage and all pumps are driven by alternating-current motors.

#### ELECTRICALLY OPERATED COKE LARRIES ARE USED

The 114 coke ovens at this plant are served by electrically operated coke larries, the electrical equipment of which is of General Electric manufacture. The results obtained with these larries, which



TWO OF THE 20-TON TANDEM LOCOMOTIVES USED BY DAVIS COAL AND COKE COMPANY

run along the top of the ovens where the heat is at times excessive and where the fumes from the ovens would be injurious to horses or mules, have been excellent. It has also been found that they are much quicker in operation, for the control is so much better that, when about to discharge into the oven, they can be moved backward or forward an inch at a time. They are used either independently or with trailers and offer a flexibility not otherwise obtainable.

The electric equipment of the larries has given virtually no trouble at all. On the other hand, as the workings in these mines have become more and more extensive, trouble has been experienced with the haulage locomotives, as the length of hauls is very great and some steep grades are necessary. The capacity of the trolley line was increased by the addition of copper in order to reduce the drop in voltage resulting when heavy loads were started up at the working face, far back in the mine, and the track bonding was also overhauled and rails put in condition; but the troubles did not

disappear entirely until a 500-kw., 600-volt, direct-current steam turbo-generator was installed in the Thomas power house. This turbine has demonstrated the particular suitability of this type of prime mover for handling the enormous fluctuations in load which occur in mining work. The normal current of this machine at full load is 833 amp., but the unit is continually called upon to handle variations from 0 to 1450 amp., which recur sometimes at intervals of a minute or less, when a train is picking up cars at the far end of the mine. The installation of prime movers possessing sufficient steadiness to stand up to this severe requirement has resulted in the entire disappearance of the former frequent burnouts of motor armatures.

#### THE ELECTRICAL EQUIPMENT IN THOMAS POWER HOUSE

The electrical apparatus in the power house at Thomas comprises two 100-kw.,

operation throughout. Five 14-ton, two 13-ton and two 10-ton locomotives, as well as four 4½-ton gathering locomotives and two electrically operated coke larries, are supplied with current from two 250-kw., 600-volt generators of the belted type. A 100-kw. Curtis turbine direct-current generator and a 300-kw. Curtis turbine alternator supply current to this mine.

There is also an older General Electric form "D" alternator which has seen hard service for many years and can now be used either as additional power, running in multiple with the turbines, or, by simply dropping off the belt and starting from the turbines as a motor, can be used as a rotary condenser for improving the power factor of the system.

#### FANS ARE ELECTRICALLY DRIVEN

At Coketon there are two pumps of 10-in. suction 8-in. discharge, two of 6-in. suction 5-in. discharge, and two of 5-in. suction 4-in. discharge. The fans at Coketon are also electrically driven. Mines Nos. 35 and 36 are connected with mine No. 34 at Thomas, and No. 35 is therefore ventilated by a split from No. 34, while No. 36 is ventilated by a 15-ft. Crawford & McCrimmon fan driven by a variable-speed induction motor. Mine No. 26 is ventilated by a similar unit.

Practically the entire output of these mines is used for the manufacture of coke, the remainder being shipped West for smelting purposes. There are 500 ovens here and all are charged electrically. The coal that is shipped West for smelting purposes is loaded in box cars with box-car loaders driven by alternating-current motors.

The power house is further equipped with two Norwalk air compressors for the coal-punching machines. M. L. Garvey is superintendent.

The next group of mines at Weaver, Randolph county, consists of Nos. 1, 2 and 3 in the lower Kittanning bed, which here shows up 9 ft. thick and provides an excellent coking coal. The three mines are operated by gravity rope haulage and have 235 coke ovens. W. W. Brewer is superintendent of this section.

The main office of the operating department is located at Thomas, W. Va., where Lee Ott, the general superintendent, resides. Mr. Ott has been with the company for many years and has, therefore, seen the company expand territorially and make great progress along technical lines. The former of these is a simple process, but to guide an undertaking of this magnitude in such technical channels, that all the best and most improved inventions and developments in the engineering world can be made available and used without accumulating a huge scrap heap at a large expense, is an achievement which requires unusual foresight and judgment.

single-phase alternators with tub transformers for town and house lighting; one 200-kw., three-phase, 60-cycle alternator for supplying power to motors operating endless belts in the breaker and those operating the pumps, of which there are four 5-in. suction 4-in. discharge, one 3-in. suction 2½-in. discharge, one 6-in. suction 5-in. discharge, and one 10-in. suction with 8-in. discharge. All of these motors are designed for operation at 550 volts. The direct-current equipment consists of one 204-kw., 600-volt and one 136-kw., 600-volt General Electric generator. The 500-kw. Curtis turbine provides current for eight 13-ton and one 20-ton General Electric locomotives, and the coke larries. L. S. McDowell is superintendent of this division.

In the Coketon division, one mile west of Thomas, mines Nos. 35, 36 and 37 are operated in the lower Kittanning seam. This coal comes to the surface at a good height for tipples with drift openings. Nos. 24 and 26 are operated in the same group on the upper Freeport seam. The mines at Coketon are all equipped for electric

## Comparative Merits of Coal Mining Investments

BY FLOYD W. PARSONS

Considerable money has been made in the purchase and sale of coal lands, but during recent years the operating end of coal mining has not proved a very profitable venture. There is no other branch of mining that has shown a smaller margin of profit above operating cost than the production of coal, this condition being generally and properly ascribed to the abundance of the mineral and to the lack of organization in the bituminous industry.

It is interesting in this connection to compare the stocks of European coal companies with similar securities in American companies. The following is a representative list of French coal investments:

Name of Company.	Par. Fr.	Selling Price. Fr.
Courrières .....	100	3180
Douchy .....	200	1110
Epinac .....	500	1995
Escarpille .....	100	1024
Grand, Combe .....	250	1413
Loire .....	100	271
Ostricourt .....	500	2952
Saint Etienne .....	100	450

It is evident, therefore, that the earnings of French coal companies are sufficient to justify a price of from three to thirty times par for their respective stocks.

The Pittsburg Coal Company is our largest coal operation and is capitalized at \$64,000,000. Since 1905 the \$32,000,000 of 7-per cent. cumulative preferred stock has received no dividend. This preferred stock is selling for \$66 per share while the common stock sells for \$19. The par value for both classes of stock is \$100.

The New River Coal Company, the largest operation in southern West Virginia, is mining the highest grade coal in the world, but has been unable to pay the dividends on its preferred stock. In both of these cases, which are typical, the mining conditions are so favorable that the mining cost per ton is often as low as 60c., while \$1.50 would be a cheap mining cost in a European mine.

Our coal seams will be even harder to replace than our forests, and it is unfortunate that with the most favorable natural conditions, and miners of the highest efficiency, our coal industry, which is national in its scope, is not on a sounder and more profitable basis.

It is altogether likely that the present unprofitable condition prevailing in the coal industry will continue until the greater part of our coal areas have been brought under the control of large interests. At present, any individual or company with a few thousand dollars capital can purchase a small coal tract and develop a mine on it with limited capital. It is unproductive

competition has been inaugurated, resulting in the elimination of all but a scant living profit for those engaged in coal mining. It is probable that the bituminous industry will in time emerge from this state of semidemoralization and be founded on a substantial basis similar to that prevailing in anthracite mining.

## Safety Chambers in Coal Mines \*

The question of furnishing mines with safety chambers has given rise to a prolonged discussion, but the problem which it has sought to solve still remains undecided. M. C. Marquet, of the French Society of Engineers in a lecture which he delivered on May 6 summarized all the experiments that have been made in this direction up to the present.

The normal safety chamber as we know, is a gallery ending in a cul-de-sac. The entrance to the gallery is protected by an air bag which can be held in place by means of compressed air at a high pressure. In the event of an emission of deleterious gases by sudden displacements in the mine, it is, by this means, prevented from entering the safety chamber where the men have taken refuge.

In France the safety chambers are very little in vogue; while, on the contrary, in Austria they are in general use. In 1908, following the accident at Courrières in which several hundred miners lost their lives, the Commission of Safety for Mineral Industries of the Nord visited numerous Austrian installations, but after examining them, the commission asserted in its report that they were of little utility.

### TESTING THE UTILITY OF SAFETY CHAMBERS

The Singles Coal Company which is at present actively engaged in making borings in the northern part of its concession, has brought the practical utility of safety chambers to the test of an actual demonstration. During the course of its operations, it has made two excavations (puits), the first to a depth of 286 m. From the bottom of this excavation a transverse cutting has been made to a length of 330 m. At a place in the cutting, about two-thirds of its length from the entrance, another well or excavation has been made to a depth of 312 m., making the bottom of this excavation in relation to the surface 600 m. in depth. The work has been carried out by means of compressed air. Safety explosives were used owing to the gaseous condition of the various strata.

On July 26, after a series of blasts had been fired during the morning shifts, a considerable quantity of carbonic-acid gas was liberated through the displacements of the rock. The volume was so large that it filled the lower excavation, the transverse cutting and the principal excava-

tion. The men who were at work in the transverse cutting at the time, found themselves underneath 280 m. of carbonic-acid gas. The shift consisted of 10 men. Of these five took refuge at once in the safety chamber, according to directions. Five others had the imprudence not to seek refuge in the safety chamber until their lights were extinguished, and it was then too late to reach it. The five were asphyxiated.

### THE RULES WERE DISOBEYED

The working rules at the time prescribed that no shots be fired until all the men were reunited in the safety chamber and that the shot must be fired with electricity from the chamber itself. The men neglected to adopt this precaution, and the consequence was that five of them lost their lives.

The role played by the safety chamber at Singles seems to have established indisputably that in mines subject to instantaneous emissions of poisonous gases through the displacement of rock or coal, a safety chamber is of great benefit. In his report upon the Singles accident, the engineer in control, M. Loiret, declares that the deduction is conclusive that the safety chamber has a relative value in the preservation of life in the mines and should be provided in collieries subject to instantaneous emanations of poisonous gas. It does not seem, he says, that their employment is to be favored in mines subject to firedamp, for an explosion in a mine affected with firedamp would inevitably destroy the compressed air conduits which keeps the air sac in position, but that in the case of an inert gas, like that of carbonic gas, and particularly azote, these chambers should render real service.

## The Scranton Mine-Cave Problem

Just how seriously the city of Scranton, Penn., is threatened by a mine cave will be determined by a commission of five engineers who have offered their services gratis. They will base their findings upon a report from two other engineers who will be engaged to make a four months' investigation of the city's underground condition. Eli T. Connor, consulting mining engineer, Philadelphia, and William Griffith, mining geologist, Scranton, have been appointed as the special investigators. Each of these engineers will be paid \$5000. The advisory committee, who are to serve gratis, are John Hays Hammond, D. W. Brunton, Lewis B. Stillwell, R. A. F. Penrose and W. A. Lathrop.

The commission will devise remedies to fit the conditions and it will then be up to the city and the school district to proceed. The actual work of safeguarding the surface will probably entail an expenditure of millions, and whether the money can be raised remains to be seen.

\*Translation of an article in *Cosmos*, May 28, 1910.



## PERSONAL

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

E. L. Dufourcq has gone to Paris.

J. E. Spurr is visiting Tonopah, Nevada.

John B. Farish has returned from a Western trip.

A. P. Rogers is going to Siberia on dredging business.

Pope Yeatman will go West about July 5, returning in about three weeks.

George E. Gunn, managing director of the Inspiration Copper Company, is visiting the East.

T. E. Helmick, manager of the Quebec Mines and Metals Company at Beauceville, Quebec, is in New York.

D. C. Botting, of Olympia, Washington State inspector of coal mines, has been visiting Chicago and Pittsburg.

Thomas D. Murphy has been appointed manager of El Favor mine at Hostotipaquillo, Jalisco, Mexico.

Mosco Vici, of Montreal, will shortly examine and report on the Payne mine, in Slocan district, British Columbia.

S. J. Speak is visiting Australia and the Far East on business for his firm, Hooper, Speak & Feilding, of London.

E. S. Mendels, agent of the New York Curb, has sailed for Europe on a vacation trip, which will last about two months.

Morton Webber, mining engineer, of New York, will leave for Europe on July 6. He hopes to return early in September.

W. J. Anderson, lately arrived at Poplar Creek, B. C. from Scotland to develop a mining property for a Scottish syndicate.

S. F. Shaw, general manager of the Montezuma Mines Company, of Costa Rica, has been visiting Los Angeles, California.

W. Spencer Hutchinson has left Boston for Mexico, where he will inspect the various mines of the Dominion Syndicate, Ltd., in operation.

J. H. Moulton, recently at Gary, Ind., has been appointed blast-furnace superintendent at Alabama City, Ala., for the Southern Iron and Steel Company.

Robert H. Stewart, Rossland, B. C., manager of the Consolidated Company's mines, has recovered from his recent severe illness and is at work again.

Oscar V. White, superintendent of the Slocan Star mine, has returned to Sandon, B. C., after having spent the winter in Arizona and southern California.

Federico Griese has been appointed manager for the Predilecta Mines Company, and also of the Guanacevi Tunnel Company, both in Guanacevi district, Mexico.

E. S. Burrows, superintendent of the electric road belonging to the Guanajuato Reduction and Mines Company, fell and broke his right leg recently, at Bustos, Mexico.

Dr. Walter O. Snelling, chief chemist of the Explosives section of the Technologic Branch of the United States Geological Survey, left Seattle, Wash., June 17 for Alaska.

H. W. Heidman, for 10 years past with the Granby company in the Boundary district, B. C., has resigned and will have charge of the Big Casino mine in the Portland Canal district.

Robert Forrester, Salt Lake City, Utah, consulting engineer and geologist to the Denver & Rio Grande and the Western Pacific railroads, is examining the oil-field around Sulphur, Nevada.

Erskine Ramsey, of Birmingham, vice-president and chief engineer of the Pratt Consolidated Coal Company, has been appointed by Governor Comer, a member of the Alabama State Mine Examining Board to succeed W. J. Brattie, of Dora, resigned.

R. L. Herrick, who has been associate editor of *Mines and Minerals*, at Denver, Colo., has resigned to go into business at Lebanon, Ohio. Geo. F. Duck, formerly a consulting mining engineer at Pittsburg, Penn., has taken Mr. Herrick's place.

Edmund D. North, formerly of Tonopah, Nev., but for a year past mining engineer for the American Smelting and Refining Company, in Mexico, fell down a winze at the Anganguo mine on June 22, receiving injuries which were believed to be fatal.

Capt. J. E. Bernier is about to take his fourth trip to the Canadian far north country. His instructions from the Canadian government include directions to make a careful search for coal and other minerals. He will be accompanied by two experienced members of the Geological Survey of Canada.

Walter H. Derriman, a well known electrical patent attorney, has entered into partnership with the firm of Dicker & Pollack, chartered patent agents, of 37 Furnival street, Holborn, London, E. C., England, and will personally conduct their electrical patent work. The name of the firm has been altered to Dicker, Pollak & Derriman.

Philip S. Smith and H. M. Eakin, both of the United States Geological Survey, early in June sailed from Seattle for Alaska, their intended route being by Skagway and Whitehorse, down the Yukon river to the mouth of the Koyukuk, then up that river to Bergman, where they will cross the divide and reach the Kobuk river country, in which various mineral deposits are known to occur.

Chas. E. Crandall, retiring superintendent of the Central Iron and Coal Com-

panies coal mine, Kellerman, Ala., and wife were presented a beautiful chest of silver by the employees of the company June 20. The presentation speech was made by Dr. Geo. C. Merriam. H. F. Byrd and Jas. Kelly made speeches on behalf of the colored employees. Mr. Crandall responded with a few well chosen words, thanking the men for their hearty coöperation and support given him at all times.

## OBITUARY

James D. May, well known as one of the pioneer prospectors and miners of New Mexico, died May 15, at Albuquerque, N. M. He was the original locator and one of the owners of the Crown Point mine at Bland, in the Cochiti district.

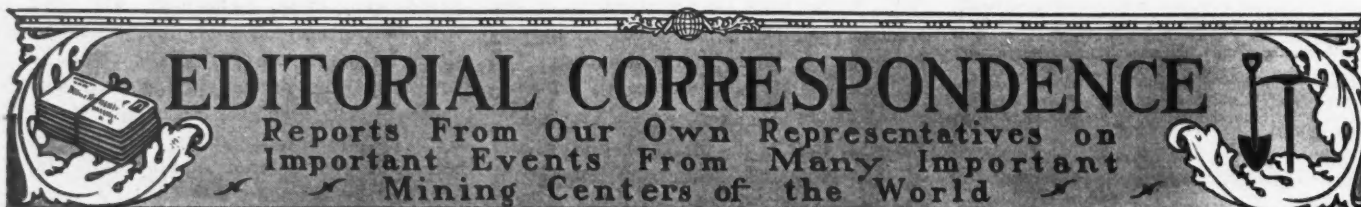
Lyndon Hoyt Stevens died suddenly in London, England, June 20, aged 68 years. He was born at Pulaski, N. Y., and graduated from the Rensselaer Polytechnic Institute at Troy; he served two years in the army. Later he studied law and was admitted to the bar. He had been connected with the Batopilas Mining Company, of Mexico, for 20 years, and president for several years. For six months past Mr. Stevens had been in Paris and London attending to the organization of the English company, which is to lease and operate certain properties of the Batopilas company.

Guy R. Johnson shot himself at his home in Birmingham, Ala., June 23, and died a few hours later. He was born and educated in Pennsylvania and earned a good reputation as a mining engineer. Nearly four years ago he went to Birmingham and established himself in that city. Later he was appointed vice-president and general manager of the Alabama Consolidated Coal and Iron Company. He was removed from that position by the board of directors a few months ago, and afterward began a suit for libel against J. R. Hoadley, then president of the company. He had recently opened an office at Birmingham as consulting engineer.

## SOCIETIES and TECHNICAL SCHOOLS

*Pacific Northwest Society of Engineers*—The eighth annual convention was held in Seattle, Wash., June 16 and 17. H. Day Hanford is the president. On June 17 a visit was paid to the works of the Western Steel Corporation at Irondale.

*Utah Society of Engineers*—The meeting at Salt Lake, June 17, is the last meeting until fall. Dr. Fred J. Pack, head of the department of geology of the University of Utah, addresses the meeting on "The Great Wasatch Fault Plane and its Relation to Earthquakes."



## EDITORIAL CORRESPONDENCE

Reports From Our Own Representatives on  
Important Events From Many Important  
Mining Centers of the World

### San Francisco

June 26—The yield of the oil wells of the State continues to increase largely. The latest reports make the estimated yield for the month of May, 7,172,502 bbl. A few months ago 5,000,000 bbl. was considered an immense yield for a month, yet it is now claimed that there is no overproduction. The daily average for May was 231,177 bbl. and consumption about 190,000 bbl., leaving a surplus of 41,177 bbl., fully accounted for by the yield of one well, the Lakeview gusher. Consumption seems to be growing as well as production. In May the Coalinga field yielded 271,100 bbl., Kern river, 1,140,000; McKittrick, 452,000; Midway, 705,000; and Maricopa district, 1,700,000, this giving a total for the San Joaquin Valley fields of 5,576,679 bbl. Of the Southern fields, the Salt Lake-Sherman produced in May, 271,000 bbl.; Los Angeles City, 38,500; Ventura county, 39,000; Newhall, 10,645; Fullerton, 424,139; and Whittier-Coyotes, 104,939, a total for the Southern fields of 888,223 bbl. Of the Coast fields, Santa Maria, Cat Cañon and Lompoc yielded 700,000 bbl.; Arroyo Grande, 600; Watsonville, 1000; and Summerland, 6000, the total for Coast fields being 707,600 bbl. The big Lakeview gusher, after running 96 days, has produced approximately 5,000,000 bbl. of oil and still continues yielding from 47,000 to 50,000 bbl. daily. The value of the output so far is estimated at \$5,000,000. The large production of the State is requiring much new tankage and new pipe lines, but the yield is so steady that contracts can now be made for long futures.

### Denver

June 27—The two great tunnels of the State are nearing completion. The Newhouse tunnel, of Gilpin and Clear Creek countries, has been driven 22,000 ft., and the breast is now near the Gunnell vein. This property, which was in the early day the biggest mine in the district, lately passed into the hands of the Newhouse Tunnel Company, or at any rate one of the largest shareholders, and it is probable that this will be the terminus of the big tunnel. This is a transportation and drainage tunnel, and built by subscription to the shares. It will drain the mines of this district, which is credited with a production of \$2,000,000 per annum for 40 years, for an average depth of about 700 ft. below the old workings. Whether it will be used largely for the

transportation of ore to its portal at Idaho Springs, remains to be seen.

The Cripple Creek deep-drainage tunnel is a coöperative enterprise, and is built by subscription from the big mines of the district, and will probably be used for drainage purposes only. It will be about three miles in length, and will render available without pumping about the same amount of virgin ground as the Newhouse, and owing to the fact that many of the biggest mines have latterly been producing rich ore from the lowest depths yet attained, the completion of the Roosevelt tunnel will cause a great revival in this phenomenal camp.

It may be noted in connection with this class of work that while none of the rock-boring machines for driving tunnels without explosives have yet been proved a success, the old methods with machine drills and explosives have greatly improved, for while five years ago an 8x9-ft. heading making a continuous average of 10 ft. per day was considered a great achievement, 14 ft. per diem is now not considered anything extraordinary. "If you can put in a round of holes, say, for instance, four or five feet deep in granite, and then blow it out at one shot, why employ unwieldy and enormously expensive machinery to take it out bit by bit?" seems to be a query that is taking fast hold in the minds of technical engineers. Of course, the latter may come, but it is here not yet.

### Butte

June 28—Manager Gillie, of Amalgamated, says there is no foundation for the rumor of production curtailment. Company's smelters at Great Falls and Anaconda were operating at full capacity before purchase of Clark properties and with the addition of Clark ores for treatment some reduction in output of other mines was necessitated to make room for Clark ores. This is the only foundation for rumor of curtailment at Butte.

In spite of this technical denial, however, there is in effect to be a curtailment of the Butte output to the extent of 5 to 7 per cent., inasmuch as the Clark smelting works is going out of commission, reducing the Butte production of copper by about 18,000,000 lb. per annum.

The effect on the city and on local business of the consolidation at Butte, which in effect makes it a one-company camp, is feared by those interested. It is reported that a number of the stores have been shut up, hundreds of houses

are to let and there is a general air of despondency throughout the entire district. This condition of affairs is partly attributable to the low price of copper, which has shut down many of the smaller properties in and around Butte, but the combination of all the Amalgamated properties is working toward retrenchment in operating, resulting not only in the laying off of many of the miners but of a number of higher salaried men as well.

Stockholders of the Butte & Superior Company have received notice of a meeting late in July in Duluth, for the purpose of adopting some plan for the refinancing of the company. The proposition laid before the stockholders follows: The present capitalization of 1,200,000 shares of the par value of \$5 to be reduced to 250,000 shares of the par value of \$10, one new share to be issued in exchange for ten old shares. A \$1,000,000 bond issue drawing 6 per cent. interest and payable in six years will be authorized. When the new bond issue has been floated it is expected that \$500,000 will be left in the treasury after payment of all debts. The new mill on the property will then be completed and the company will be ready to treat between 800 and 1000 tons daily.

### Salt Lake City

June 26—The Utah Ore Shippers' Agency has recently been formed, and is now operating in Salt Lake City. The purpose of the organization is to look after the interests of the shipper on ore consignments to the local market, and to provide care and inspection in the matter of weight, moistures, assays, etc. The agency has an experienced man at each sampler who gives constant supervision to all consignments from the time they are received to the delivery of the pulp to the assayer. An office is maintained to check assays and settlements and to give general information regarding rates and market conditions. The officers and directors are: David Taylor, president; R. B. Silverman, secretary and treasurer; E. C. Lackner, and S. R. Neel.

Progress is being made in the driving of the Snake Creek tunnel, which is now in a distance of nearly 500 ft. A 35-h.p. gasolene locomotive, made by the Milwaukee Locomotive Manufacturing Company, has been ordered by Free & Taylor, to be used for haulage purpose in the tunnel. Contractors are figuring for supplying and placing the air pipe. The pipe laying will extend through a period

of three years, and the bids call for the placing of so much piping per month, provided the progress on the tunnel itself is not delayed.

A No. 5 Roots blower of 3000 cu. ft. free-air capacity, which is driven by a 35-h.p. General Electric motor, has been installed. Up to the present time little bad ground has been encountered and no timbering whatever has been used. All equipment and machinery is in smooth running order, and no difficulty is anticipated in maintaining the requirements of the contract for upward of 300 ft. per month. The tunnel will be of interest in cutting the lower limestone series of the Park City formation, which lie below the Ontario quartzite, as relatively little is known about this ground.

The taking of testimony in the case of the Silver King Consolidated vs. the Silver King Coalition was concluded June 11. The court set Sept 19 for the submission of briefs and the final summing up of the case before Judge John A. Marshall.

#### Goldfield

June 26—Mining activity throughout the Goldfield district appears to be steadily on the increase. The Consolidated and Florence companies are, of course, constantly operating. A week ago the Combination Fraction started milling and the condition of the mine warrants the assumption of continuous production. Operations have lately been resumed by the C. O. D. company, and several new leasers have begun work. Aside from company operations there are 32 active leases, 7 of them producing. Work is being carried on in every part of the district and at almost every depth from 100 to 1500 ft. With so much development under way the ore should be discovered sooner or later if it is there. Of three leases on Merger ground one is a steady producer with improving prospects with depth. The Sandstorm-Kendall merger is being worked out and development will commence shortly. Three miles west of the "proven" zone the Nevada Eagles is extracting shipping ore and the Nevada Victor is sinking in the same locality. To the south the Pittsburg and Frances groups are soon to be more thoroughly prospected and north of Goldfield the Daisy, Belmont, and Great Bend, with two leases each, are scenes of constant activity.

#### Birmingham, Ala.

June 27—Dr. David T. Day, of the U. S. Geological Survey, after visiting the Louisiana oilfields, stopped over in the Birmingham district recently, looking at the new Fayette county natural gasfield. He will make a report to the survey upon his return. Much drilling is now going on in the western part of Alabama for oil.

Negotiations are on for the purchase of a large tract of brown-ore land in Cherokee county, and the belief is expressed that before long there will be active operations there.

Reports have it that organizations are being perfected for the construction of a railroad 16 miles in length, direct from the coal-mining center to the Warrior river, which is navigable to the Gulf, thereby giving a closer water connection for the Birmingham district.

At Crudup, near Gadsden, in the mines of the Southern Iron and Steel Company, diamond drills have struck a second vein of red ore, below the vein now being worked. So far as proved, the vein is over 4 ft. thick.

Charles E. Crandall, who has just retired from the position of superintendent of the Central Iron and Coal Company, originally located the mines and sold to the company a tract of several thousand acres of the best coal land in the State. After the organization of the company in 1901, Mr. Crandall was made superintendent of the Kellerman division. He opened the mine in April, 1901, and has developed and managed it since that time. The Kellerman mine has a larger output than any other single-entry mine in the United States, having run over 1600 tons in a single day over one tipple. At the present date, 98 per cent. of the developed coal will be recovered. The State mine inspector says that it is a model mine.

#### Cobalt

June 26—Ten Cobalt mines have declared dividends amounting to \$1,710,925 payable between June 15 and Aug. 15. Several annual reports have lately been issued that show gratifying results, the one of chief interest being that of the La Rose company. The action of the directors last year in cutting the quarterly dividend from 4 to 2 per cent. was the hardest blow that the Cobalt camp had received since the Nipissing fiasco. For the year ended May 31 the La Rose production is given as 3,150,000 oz., and as dividends are now being paid at the rate of \$600,000 per year, this will give a much strengthened treasury reserve. The more optimistic feeling which now prevails regarding the property is also attributable to the improved physical condition of the various workings. Excellent results are being obtained at the Lawson and the Princess is becoming a steady producer.

The report of the Buffalo also shows a general increase in production, profits, dividends and ore reserves. During the year 33,708 tons of ore averaging 40 oz., were treated in the concentrator and cyanide plant, and an extraction of 82.67 per cent. was made. The cyanide plant produced 54,479 oz., while the combined total production for the year was 1,491,750 oz. The increase in dividends over

the past year was \$142,000, and there has also been a big increase in ore reserves.

The management of the Reeves-Dobie property in Gowganda has decided to install a small mill to treat the lower-grade ores. Freight rates from this district to the smelters are so high that it is practically impossible to ship medium- and low-grade ore at a profit, and as there seems to be no chance of a railroad being built, the only other alternative is to put up concentrators. The machinery for these will have to be taken in during the winter, when transportation will be better and freighting charges less.

Several good discoveries of silver have lately been made on the Quebec side, particularly in the township of Fabre. The formation is largely Keewatin and diabase, and the best veins have generally been found at or near the contacts. This county has been coming more into prominence since the change in the Quebec mining laws, and it is worthy of serious consideration.

#### Toronto

June 26—The Cobalt "high-grading" cases, which have been before the courts for some time, were decided June 22, when Judge Winchester passed sentence on several convicted of illegal sales of ore, the charges of theft being withdrawn. These prosecutions were under the old law, which was extremely lax. Since the enactment of more stringent provisions, future offenders will not get off so easily.

A merger of the four larger natural-gas companies operating in southwestern Ontario, the Volcanic Oil Gas Company, Chatham, the United Fuel Supply Company, Sarnia, the Northern Pipe Line Company, and the Leamington Oil and Gas Company, is being negotiated, with the object of securing control of the entire field. The movement is being promoted by a British syndicate and, if successful, the new company will be capitalized at \$5,000,000 and the pipe line will be extended to London, Ontario.

The first ore shipment by way of the Montreal river was made last week, consisting of 800 sacks of second-grade material sent out by the Millerett Silver Mining Company, of Gowganda. The freight was \$2.05 per 100 lb. Should it be found sufficiently economical to ship by this route, consignments will be forwarded by a number of Gowganda and Elk Lake properties.

#### Mexico

June 25—Announcement is made that the National Railways has secured control of the Pan-American railroad recently acquired by David E. Thompson and that the Tehantepec National and the Vera Cruz and Pacific lines will also be acquired by the Government merger.

# THE MINING NEWS

Reports of New Enterprises, New Machinery, Installations, Development Work and Property Transfers The Current History of Mining

## Alaska

A 10-stamp mill is to be erected at Chena, Fairbanks district. This is a co-operative enterprise to finance which claimholders are being assisted by commercial companies interested. Individual claimholders will be enabled to test the ore of their quartz claims in development. A. Cunningham has been engaged to put up the mill and operate it for a year.

## Alabama

The various safety appliances in the coal mines of the Tennessee Coal, Iron and Railroad Company—which were described by E. H. Coxe in an article in the JOURNAL of June 4—have been inspected by a party from other coal-mining operations of the United States Steel Corporation. The party consisted of Edward O'Toole, general superintendent, and H. M. Eavenson, chief engineer, of the United States Coal and Coke Company, Gary, W. Va.; F. P. K. Miller, chief engineer, and Austin King, chief mine inspector, of the H. C. Frick Coke Company, Scottsdale, Penn. They passed 10 days at the mines in the Birmingham district, and on their way north will stop to inspect the mines at Whitwell, Tenn., also owned by the Tennessee company.

## Arizona

### GILA COUNTY

**Warrior**—Drill hole D, on the Mobile claim, 1000 ft. southeast of the underground workings of the mine, has been sunk 115 ft. and is still in the capping of impure schist. Stopping on the western portion of the property, on and above the 300-ft. level, is being done for 300 ft. The property is still shipping 100 tons of 10 per cent. ore daily. Beginning July 1, it will discontinue shipments to the El Paso smeltery and have its ores reduced at the Old Dominion plant.

**Miami**—At present, this property has 15 working faces. One thousand feet were driven during the week ended June 18. At present, the 420-ft. and 570-ft. levels, which will be the main haulage levels of the mine, and all levels and sub-levels between the 420- and 245-ft. levels are being worked to some extent, although the bulk of the work is being done in the north-western portion of the mine, much of it on the St. Johns-Red Rock claim. At this point, the first actual extraction of ore will occur when production begins. Blocking out at this point has revealed a greater body of ore than the original estimate of 120,000 tons. It was at first sup-

posed to be a tip of the orebody at that place, but is now known to contain no less than 560,000 tons, enough to supply the concentrator at the rate of 2000 tons daily (as planned) for 280 days. On the 370-ft. level, a drift is being driven north-west from shaft No. 4 (the main working shaft) toward the Captain claim. This drift west for 525 ft. from the shaft was in the orebody, entering at that point the Schulze granite. At 1000 ft., the drift was turned northward, still in granite. At 220 ft. in this direction, it again entered the orebody, which has been penetrated 40 ft. to the present face. The ore averages about 3 per cent. copper at the breast.

### MOHAVE COUNTY

**Keystone**—This mine has made a high-grade silver strike on the 150-ft. level west.

### PINAL COUNTY

**Ray Central**—The company has won in its suit against a town-site syndicate.

### YAVAPAI COUNTY

**United Verde Extension**—The developments on the recently disclosed orebody continue favorable.

## Arkansas

**Helena Zinc Mining Company**—This company has been organized at Helena, Mont., to operate in the Buffalo mountains, Marion county. The same interests have the Yellow Jacket mine in this district, of which James McCarty is manager.

## California

### AMADOR COUNTY

**South Eureka**—At this mine underground operations will stop about the first of August and work of straightening the shaft will begin.

### BUTTE COUNTY

By confirmation of administrator's sale, R. M. Green, of Oroville, has come into possession of the O'Reilly land near Forbestown, and will now develop the quartz veins.

**Wild Yankee**—This mine, near Inskip, will be reopened and developed by Chico capitalists.

### ELDORADO COUNTY

**Bright Hope**—Julius N. Lawton, of Stockton, Cal., has bonded this mine near Georgetown and is building a 5-stamp mill for prospecting.

**Red Horse**—Pottle & Blake, of Deer Valley, are mortaring rich quartz from this mine and plan a small mill.

## KERN COUNTY

**Golden Jackrabbit**—George W. Hull, of Jerome, Ariz., J. B. Ferris and others have purchased a 70-ton mill for the Ocher mine, 8 miles east of Caliente, and are also installing electric drills; other improvements are being made toward the property on an extensive scale.

### MODOC COUNTY

**Consolidated**—Some very high-grade ore has been developed lately in this mine in Hoag district.

### MONO COUNTY

**Casa Diablo**—A gold brick worth \$2700 represents the first 25 days' milling of this mine, the days being eight hours each.

## NEVADA COUNTY

**Wisconsin**—Work of installing machinery and putting up buildings at this mine, Washington, has commenced under supervision of Frederick Medlin.

**Powning**—This Grass valley mine under bond to C. D. Tregonning is yielding good ore. It is expected that a company will soon be organized to work the property on a large scale.

**Last Chance**—In this mine, Washington district, the outlook is good. The property has a 10-stamp mill and other machinery.

**Erie Consolidated**—The Erie lode has been cut on the 500-ft. level. It is 12 ft. thick and yields good concentrating ore for which a mill will be installed.

**Red Ledge**—Specimen rock is being taken from this mine, at Washington, owned by Williamson Brothers and Clyde Cole.

### PLACER COUNTY

**Red Bird**—George A. Tubb, owner of this mine, is interesting capitalists in it and expects to erect a mill.

### PLUMAS COUNTY

Joseph Young, of San Francisco, and H. J. Langhorst, of Quincy, have obtained a bond on a new vein four miles south of Sloat station on the Western Pacific and are preparing to do extensive development.

### SHASTA COUNTY

**Gold King**—This mine, on Mule mountain, has again commenced to ship to the smelteries.

**Mammoth**—The bag house went into commission July 1. This is in conformity with the agreement with the farmers' association. The bag house contains

3000 bags and will handle all the gases from the blast furnaces and the converter.

## SIERRA COUNTY

*Kate Hardy*—This mine at Forest continues to produce bonanza ore.

*Slug Cañon*—Strikers of rich ore on two claims in this cañon near Downieville have just been made. These claims are on the same serpentine contact as that on which are located some of the best mines at Alleghany and Forest, six and nine miles south of Downieville, and Sailor ravine four miles north.

*Ladies Cañon*—Lee Brothers, on their claim in this cañon near Sierra City, have taken out between \$40,000 and \$50,000 worth of rich ore since June 1.

*Tightner*—H. L. Johnson has refused \$20,000 cash as a bonus on an option for 30 days. The option price offered was \$2,500,000 and was from German capitalists. The vein in the mine 700 ft. below the old workings is about 8 ft. wide and shows gold from the hanging to the footwall.

*Rose Quartz*—In this mine near Gibsonville, they are finding high-grade ore which is shipped by express.

*Sovereign*—This company near Downieville is running a 1600-ft. tunnel to tap a known shoot of good ore.

## SISKIYOU COUNTY

*Victor*—The mill at this mine at Hornbrook is being enlarged and excellent milling ore is being produced.

*Siskiyou Syndicate*—This company, I. J. Luce, president, is working the Blue Jeans and Cub Bear groups near Etna and getting good results.

*Mount Vernon*—This property near Yreka has been leased to H. L. Wollenburg, of Berkeley. A new electric hoist and a compressor have been put in.

*Zarina*—This company at Etna, which recently ceased operations for lack of funds, is about to start up again with H. M. Sevenman manager.

## TUOLUMNE COUNTY

*Karnac*—Arrangements have been made to build a mill on this mine near Jamestown. A gasolene engine will provide power.

*Tiger*—A. G. McAllister and J. B. Oneto have a lease on this claim and are taking out good ore.

## Colorado

Plans now being worked out by Franklin Guiterman, of the American Smelting and Refining Company, as chairman of the mining committee of the Denver Chamber of Commerce, are expected to result in a general revival of mining in many old districts of Colorado. The mining committee of the Chamber has just been organized and Mr. Guiterman announced on being chosen chairman

that he would make every effort to build up the mining industry of the State through the committee. Representatives will be sent to the various camps of the State to learn how the low-grade ores are being treated, and an effort will be made to make use of much of the ore that is now thrown aside because of the small amount of mineral in it. Other members of the committee are Thomas F. Wilkinson, H. A. Lowe, W. W. Love, Jr., and Walter G. Byrlingame.

## CLEAR CREEK AND GILPIN COUNTIES

*Seven-Thirty*—A strike of 8 to 12 in. of smelting ore is reported by lessees working under the rich Schauer stope in this property. The ore yielded 340 oz. silver and 15 per cent. lead.

*Running Lode*—The Porter mill building has been leased by Denver parties, and machinery has been installed to treat ore from the Running Lode dump, leased by the same people.

*Ibex*—The Allan, Clemens & Crombe lease is still producing high-grade gold ore.

*Bald Mountain*—A drill with a capacity of 2500 ft. has been installed on this property, at the head of California gulch.

*Federal Mining and Milling Company*—This company has acquired the Pewabic, Russel and Homestake properties in Gilpin county.

*Honest John*—This Chicago Creek tunnel is in 2200 ft. The Marysville vein will be cut in 150 feet.

*Conqueror*—Excavating is under way for the 100-ton concentrating, amalgamating and cyaniding mill to treat the ores of this Cordove mountain mine.

*Pewabic*—C. Niccum, of Black Hawk, has leased the dumps of this old mine and expects to make shipments of four or five cars per week.

*Vidler*—Charles Fuller has taken a contract to complete this tunnel, driving 300 ft. a month. The Montezuma & Western railroad is financing the work. Electric power will be used. The bore is 10x20 ft. in the clear and will be used for transportation purposes, mainly affording an outlet for the Montezuma district.

## GUNNISON COUNTY

*United Colorado*—Additional concentration machinery and a cyanide plant will be installed. Electric power is used. About \$900,000 has been spent on development. Edward L. Dufourcq, of New York, is consulting engineer.

## SAN JUAN DISTRICT

*Lewis*—This mine, owned by Livermore & Wells, has contracted for a 100-ton concentrating mill.

## SUMMIT COUNTY

Three dredges are at work at Breckenridge.

*Quail*—The property at Montezuma will install power drills. B. F. Ames is superintendent.

*Kimberly-Wilfley*—Men are at work cleaning out this property preparatory to resumption. The mill is nearly completed. The old company has been reorganizing its finances.

## TELLER COUNTY—CRIPPLE CREEK

*Pharmacist*—Ward & Hill, lessees, are producing from 75 to 90 tons per week of ore, yielding \$23 per ton.

*Home*—A strike of rich ore is reported as having been made by lessees on this Beacon Hill mine, at 450-ft., the ore assaying 7 oz. per ton.

*Abe Lincoln*—A two-car shipment from this Poverty Gulch mine has just been made by W. J. Hill, lessee. The ore comes from a 4-ft. vein in the lowest level. The gold occurs as sylvanite and assays 5 oz. per ton.

*Fluorine*—Ore mined from the surface deposit of this mine is being milled successfully, it is said, at the rate of 75 tons per day, at the Copper Mountain mill.

*Black Diamond*—Lessees operating this property on Tenderfoot hill, north of the El Paso-Gold King, are reported to have discovered a body of good ore at 265 feet.

*Stratton's Independence*—Richard Sampson, lessee, has opened up ore in the old tennis court near the Portland boundary line, and \$40 ore is being shipped from an opencut on the vein.

*Blue Bird*—It has been decided to lease this mine from the 700-ft. level upward to the surface, and A. Pearce, the new superintendent, is at work sampling this portion of the mine. From the 700-ft. level to the bottom level, 1350 ft., the mine will continue to be worked on company account.

*Hoosier*—Hill & Russell have taken a lease on this Tenderfoot Hill mine and work will be commenced. The mine is owned by the Grafton Gold Mining Company and is credited with a production of \$350,000.

*Golden Cycle*—Negotiations for the sale of this mine have been renewed.

## Idaho

## COEUR D'ALENE DISTRICT

*Reindeer*—Several cars of copper ore are ready to go to the smeltery as soon as the wagon road is finished, which will be about July 4. The ore was concentrated by hand jigs but other methods will be used when the road permits machinery to be taken to the mine.

*Success*—The Success zinc mine has been inspected by the Mayo-Sachs company, of Butte, and by Senator W. A. Clark with a view of purchase. H. F. Samuels, the principal owner, has refused to accept the price offered.

*Federal*—The new sorting plant of 800 tons capacity at Mace has been put in operation, replacing the one destroyed by fire last winter.

*Emma*—A working option, for a year, price \$30,000, has been secured on this gold group by John Leicht and W. M. Walker, of Spokane.

#### Indiana CLAY COUNTY

The suit of the employees of the McIntosh Coal Company against the company for the loss of tools will be heard soon. Two years ago the men in the mine were laid off, they claim, for a few days, and left their tools in the mine. The mine did not resume operations, but was flooded with water and the tools were ruined. The employees hold that the company was responsible for the loss.

*French-Nicoson Coal Company*—The mine tippie which had just been completed at Bentwood was destroyed by fire June 23. The mine had recently been completed and was ready for operation. The tippie will be rebuilt at once.

#### GIBSON COUNTY

An increase in completed oil wells in the Oakland City field is reported. The Ohio Oil Company is securing right-of-way for a pipe-line to connect this field with the main trunk lines of the company in Illinois. Four new wells have been completed with an estimated production of 300 bbl. The Southwestern oil-field is being extended and great interest in development and the securing of land continues.

#### ST. JOSEPH COUNTY

Considerable interest has developed in the sinking of an oil well near New Carlisle. At 500 ft. a good showing of oil was found and gas in great quantities. The drilling was done under the direction of the Standard Oil Company, to test the field. A peculiar fact is that as soon as oil was found, drilling operations were stopped. Thousands of acres have been leased on the strength of the find.

#### SULLIVAN COUNTY

Since the settlement effected between the miners and operators of District No. 11, the mines in this vicinity have broken all records. The payroll for June 25 was the largest in the history of Shelburn, aggregated \$64,000. The mines have orders enough booked ahead to keep them running full time all summer.

#### VIGO COUNTY

The Riverside mine resumed work June 22 after several days layoff. The trouble was over the hoisting of the miners' tools and also about the pumping of the water from the mine. The trouble was adjusted by Vice-president Lacey, of the Mine Workers' Union, to the satisfaction of both parties.

#### Kentucky

*Cumberland Mining Company*—This company has been incorporated, with office at Glasgow, to develop lead mines in Monroe county. The company has leased the mineral rights on several tracts on a belt extending from Hunter's Point to Marrowbone.

#### Michigan COPPER

*Lake*—At the annual meeting of the company held at Houghton June 21 the following officers and directors were elected: W. A. Paine, president; R. H. Gross, secretary and treasurer; J. H. Rice, R. C. Pryor, R. T. McKeever, W. F. Fitzgerald and G. L. Stone. With the exception of Messrs. Rice and Pryor, the board is composed of new members. The company's offices will be moved to Boston and in all probability F. W. Denton, general manager of the Copper Range Consolidated will have direct charge of the work at the mine.

*Keweenaw*—All operations on the main tract are centered at the Kearsarge shaft, which is down 225 ft. drill operations being suspended. At the Phoenix tract, which this company controls the second drill hole is going down to ascertain conditions of the Ashbed lode 1500 ft. from the site of the first hole and at a greater depth. The lode, as shown by the first hole was 120 ft. through and 70 ft. of it was well charged with copper.

*New Baltic*—The company has started a shaft near the No. 2 drill hole in section 16 and should reach the point from which this hole cut a promising copper formation at 350 ft. The overburden at the shaft site is estimated at 20 feet.

*Ahmeek*—This company's stamp mill is now handling about 850 tons of rock daily while about the same amount is being divided between the Tamarack and Franklin mills.

*Cherokee*—This company is operating two drilling outfits. No. 1 is down 550 ft. and No. 2 over 1100 ft. Some copper formations were cut but not commercial.

*Osceola*—No. 4 shaft of the North Kearsarge branch is sending 350 tons of rock to the mill daily. It is bottomed at the 14th level, but drifts from the 20 and 22 level of No. 3 shaft have proved the ground beyond the line of this shaft and it is up to the average from this lode. No. 1 shaft of the South Kearsarge branch is at the 22d level and No. 2 at the 6th with all the opening above showing a fine grade of rock. At the coal dock, owned jointly by this and the Tamarack company an additional unloading device, capable of handling about 1500 tons of coal daily is being installed. Preparations are being made to remodel the stamp mill.

*South Lake*—No. 2 drill hole has been discontinued at 2350 ft. where a conglomerate formation was entered. A num-

ber of copper-bearing lodes were cut during drilling but nothing of consequence. This company is operating another drilling outfit at No. 3 hole.

#### IRON

*North Lake*—This iron mine, four miles west of Ishpeming, developed by the Cleveland Cliffs company, will ship soon.

*Standard*—This mine, near Republic, has been optioned to Matthew Gibson and will be explored.

*Kloman*—These Republic properties are being explored by the Jones Furnace Company of Iron Mountain.

#### Missouri

*Toledo-Aurora*—This company is sinking a shaft and will drill 20 acres of the Decatur land joining the Daisy Bell. C. D. Buckley is in charge.

*Lockport*—Four large pumps are draining this property near Galena.

*West Seventh Street*—This company has three holes in ore at 150 ft., which opens up new ground.

#### Montana

##### BUTTE DISTRICT

*Anaconda*—The Butte council has passed an ordinance permitting the Butte, Anaconda & Pacific railway to extend its tracks to the ore bins of the newly acquired Stewart mine and construction work will be begun immediately. Ore from the Stewart will then be shipped to the Washoe smeltery, at Anaconda.

*Butte-Ballaklava*—The annual statement of production shows that the company has been making regular shipments since March, 1910 (starting in with 50 tons daily and gradually increasing until from 100 to 140 tons are the present daily output. Returns from ore shipped to June 1 were \$111,558. Operating expenses for the year, during the greater part of which only development work was being done, were \$168,498, thus leaving a loss for the year's operations of \$56,939.

*Elm Orlu*—The annual report of the net proceeds of this property, which is still retained by W. A. Clark, is as follows: Gross income, \$579,438; total expenses, \$559,274; and net proceeds, \$20,164. The number of tons extracted was 55,996; yield per ton, \$14.34; cost of extraction, \$4.25.

*Tuolumne*—The annual report of net proceeds is: Tons extracted, 19,484; yield per ton, \$19.75; cost of extraction, \$3.59; cost of transportation per ton, \$0.75; cost of reduction per ton, \$5.59; net proceeds for year to June 1, \$112,619.

*Original*—The company, which owned the group of mines recently sold by W. A. Clark to the Anaconda company, has filed its annual report of net proceeds as follows: Number of tons extracted, 226,492; gross yield per ton, \$8.10; total gross yield, \$1,834,585; cost of extrac-

tion, \$915,970; cost of transportation, \$48,763; cost of reduction, \$688,492; cost of labor, \$547,751; cost of supplies, \$368,219; net proceeds, \$181,359.

#### GRANITE COUNTY

In the Georgetown district, Victor Ernst and Michael Benson, who are leasing on the Revenue mine have driven the tunnel in 100 ft. and expect to encounter the old lead shortly. At the Southern Cross no new information is obtainable concerning the proposed sale of the property. A crew under Superintendent Allen has recently cut a new vein on the property. At the Modoc mine operations are being pushed under the direction of E. H. Pitcher. William McIntyre, Andrew Nelson and others are working the American Flag mine and have sunk a 100-ft. shaft. Considerable ore is now on the dump waiting for the commencement of operations at the Milwaukee mill, which will start up soon. At the old Red Lion property, George W. Gordon is operating a 5-stamp mill by water power.

#### JEFFERSON COUNTY

**Corbin Copper**—This company, at the head of Clancy creek, has about completed its concentrator and will soon put it in operation.

**Boston & Corbin**—A new electric pump has recently been installed and development work continues.

**Boston & Alta**—The company is ready to put its electric plant in commission. From the bottom of its 700-ft. shaft a crosscut has been run to cut the lead.

#### LEWIS & CLARK COUNTY

In the Scratch Gravel district five miles northwest of Helena, the Copper-Silver Montana Mining Company is sinking its shaft, now down 320 ft., to the 500-ft. mark, when crosscuts will be run to the veins. E. R. Purnell is in charge. The Hendricks Brothers are working the Strawberry mine at the head of Skelly gulch. The main shaft is down 180 ft., at which depth a crosscut was run to the Strawberry lead, which was shown to be 16 ft. wide. A tunnel will now be run 480 ft. to tap this lead. The construction of a new 10-stamp mill will be begun at once.

#### LINCOLN COUNTY

**Idaho Gold and Radium**—The property is at Leonia, 25 miles west of Libby. A sawmill is being built while hydraulic giants and other machinery are being shipped to the property. A vein containing pitchblende and gold ore is thought to carry radium.

#### MADISON COUNTY

**Pony Original and Mascott**—The Eling Estate Company and the heirs of W. W. Morris have given a lease and bond to Leroy D. Ball, on the property in the Norwegian district. The purchase price is \$25,000. A condition of the lease

is that a plant sufficient to treat 100 tons of ore daily be erected on the Pony Original claim by the lessee.

#### MISSOULA COUNTY

**Iron Mountain**—On the 1800-ft. level the 170-ft. crosscut to the lode has been finished and 16 ft. of silver-lead milling ore has been uncovered. The old 100-ton mill, now on the property, will be overhauled and put in commission. A new unit will be built and when this is in working order the old mill will be torn down and a new one erected. When the orebody on the 1850-ft. level has been cut the shaft will be sunk another 200 feet.

**King & Queen**—A 75-ton mill will be erected to handle the galena ore opened.

#### POWELL COUNTY

**Victory**—A 30-ton mill will be erected just below the portal of the 650-ft. tunnel now being driven to tap the Victory vein, and power will be generated at the company's hydroelectric plant. N. W. Logue, of Los Angeles, is inspecting the property preparatory to designing the mill.

#### YELLOWSTONE COUNTY

The coal mines at Roundup are employing more than ever before and the monthly payroll is now \$80,000. The mines are producing 3500 tons daily. At the No. 2 mine operations have been recently curtailed to allow the installation of a number of improvements, looking to the eventual electrification of the mine. Excavations are being made for a Holmes lift and new runways, by which the empty mine cars will be distributed by force of gravity. When the improvements are completed the output of this mine can be increased to 2500 tons daily. The mines of the Davis Coal Company are being developed and about 100 tons are being mined daily in conjunction with the development work.

#### Nevada

##### ESMERALDA COUNTY

**Goldfield Consolidated**—Foundations will soon be complete for the big storage tank being constructed near the top of Columbia mountain to afford high-pressure water supply in case of fire. Standard fire hydrants will be connected with 4-in. mains at various points all over the property and every precaution will be taken. The entire 100 stamps are dropping.

**Combination Fraction**—The Nevada-Goldfield mill, leased by the Fraction, is in operation at full capacity, 20 stamps.

**Goldfield Annex**—The shaft is now well past 900-ft. level. At 1000 ft. a station will be cut.

**Black Butte**—Stock in the reorganized company has been issued on the surrender of old stock and payment of a 1c. assessment.

**Atlanta**—Seven leases are in operation at from 280 to 750 ft. The vein contains broken quartz intermixed with alunite and iron pyrites, with stringers of gray copper and famatinite.

#### LINCOLN COUNTY

**New York-Searchlight**—It is said that \$40,000 will be expended for equipment and that \$60,000 more is available for development. A mill and an electric plant are planned.

**Bamberger-Delamar**—Fred Falkner, receiver for the one-time big producer, will sell the remaining machinery, the mining claims and other property, July 15.

**Centennial Pioche**—Active operations have been resumed as a result of the reconstruction of the Clark railroad, which was washed out Dec. 31.

#### NYE COUNTY

**Tonopah**—The west drift on the 600-ft. level of the Red Top workings has exposed a strong face of ore. The new Sand Grass shaft is now down 342 feet.

**Tonopah-Belmont**—In addition to 220 tons milled daily, several cars per week are being shipped to the smeltery.

**Montana-Tonopah**—Semi-monthly melt of cyanide precipitates, produced 23 bars of bullion worth nearly \$18,500. In addition, 50 tons of concentrates were marketed.

**West End**—The heavy construction work in connection with surface plant improvements is complete. It is expected to have the Crane washer and picking belt in operation shortly.

**Keane Wonder**—Plans for the installation of 20 stamps, thereby doubling the capacity of the mill, will be carried out if the long tunnel now being driven shows expected results.

**Round Mountain**—A second tube mill and Blake crusher, and two new Huntington mills will bring the mill capacity to 200 tons daily.

**Jumping Jack**—A special stockholders' meeting has been called with a view to ending litigation and consolidating with the Manhattan Dexter company.

#### WHITE PINE COUNTY

**Giroux**—The high-grade ore will be shipped to the Tooele smeltery. Four churn drills are at work on the property.

**Ely Centennial**—The tunnel is in 1000 ft. Work has been resumed.

**Nevada Consolidated**—The company may drive a transportation tunnel starting about 1500 ft. down Juniper cañon.

#### North Carolina

A Pittsburg company is developing gold properties in Montgomery county under direction of Louis Dunker.

## Oklahoma

*Blue Rock*—The company is prospecting the Jennie May lease at Miami.

## South Dakota

*Lexington Hill*—This property, near Deadwood, is being investigated by a Colorado company.

*Gold Medal*—This Pennington county property is planning resumption.

*Homestake*—The company is installing a creosoting plant to treat all its mine timber. The plant is near Deadwood.

## Texas

A shipload of iron ore has been sent from Texas City to Philadelphia for testing. It is from the deposits in eastern Texas recently investigated by the Schwab interests.

Drilling a few miles east of Laredo, has developed a gas well and the gas may be utilized in smelting zinc ores. The operations are at Reiser, about 10 miles from the Texas-Mexican railroad. Reiser Brothers, in boring for water, struck gas.

## Utah

## BEAVER COUNTY

*Michigan Mining Company*—The drift on the 200-ft. level has opened a 12-in. vein of lead-silver ore which is being saved for shipment. The drift is still 300 ft. from where ore was expected. Work is being pushed.

*Cedar-Talisman*—Returns have been received on two carloads of zinc ore, which were shipped from the new strike in the Talisman to Bartlesville, Okla. The shipment ran 44 per cent. zinc and gave net returns of \$2335. This ore is partly a zinc silicate and carbonate from the 125-ft. level. The same orebody has been opened on the 225-ft. level, and a raise is being driven to connect the two levels.

*Bradshaw*—A 6-ft. vein of iron ore carrying gold has been partially developed on this property. A contract has been given for another 100 ft. of drifting, after which plans for larger development will be laid out. The company is controlled by Ohio and Utah interests.

*Utah Gold and Copper*—Machinery for the new concentrating mill has been ordered, and will be shipped within the next 10 days. Work on the excavation and foundations for the mill has been started. A new hoist will be installed.

## JUAB COUNTY

*Lower Mammoth*—No material change has occurred in the new winze from the 2000-ft. level. Shipments are being made from the orebody between the 1700 and 1800.

*Dragon Iron*—The shaft is now 600 ft. deep, and is to be sunk to the 1000-ft. level to prospect the ground underneath

the deposit of iron ore, which is being mined. About 250 tons of ore are being mined daily, and this production will not be interfered with by work on the new shaft.

*Opohongo*—Drifting is being done in two directions on the vein on the 1400-ft. level, and a continued improvement in the showing is reported. The ore which is being shipped comes from the 350- and 400-ft. levels.

*Victoria*—Sinking of the shaft has been commenced. It is intended to sink from the 550- to the 1100-ft. level, so that ore can be hoisted through the company workings instead of through the Grand Central mine.

*Tintic Combination*—The drift east of the shaft on the 200-ft. level is in mineralized ground, carrying much iron. It is thought to be approaching the Aspinwall vein.

*Clift*—This property near Silver City is shipping from one to two carloads of silver-lead ore per month. Stopping is being done on a fissure from 4 to 7 ft. between walls. The upper tunnel is in porphyry. A lower tunnel which is being driven to get under the old workings is in limestone, and shows that the porphyry does not extend to this depth. This tunnel has been driven 1400 ft., and has 250 ft. more to go to reach the vein.

*Grand Central*—The new orebody in the western part of this property has been opened up for production and the output is better than a carload of ore a day. The older workings east of the shaft are also producing, especially those between the 1100- and 1250-ft. levels. A new drift is being run for this ore on the 1300.

*Sioux Consolidated*—During May, 63 carloads of ore were marketed, which brought net smelting returns of \$30,343. The operating expenses for this period are given as \$12,843.

*Governor*—Work has been started to reach the Governor claims through the Black Jack, which adjoins on the west. The work is being done from the 300-ft. level of the Star Consolidated shaft, now owned by the Black Jack. Both properties are controlled by the Knights. The Iron Blossom is following the gold-copper vein on the 500 level, and is near the Governor lines.

## PIUTE COUNTY

*Shamrock*—Three feet of shipping ore, carrying gold, silver and copper, have been opened in this property, near Marysvale. The vein has been sunk on for 50 ft. below the tunnel level and a new tunnel is being driven to cut it 90 ft. below the bottom of the winze. A car of ore has been shipped.

## SALT LAKE COUNTY

*Utah Apex*—One hundred and seventy-five tons of ore are being mined daily

in about equal proportions from the Dana and Louise orebodies. The company is employing 125 men on three shifts in the mine and mill. The mill is giving good results and is turning out from 50 to 60 tons of concentrates daily, which run about 40 per cent. lead.

*Columbus Consolidated*—A cave has been cut in a raise about 60 ft. above the 400-ft. level. When this was reached a flow of water carrying finely divided sulphide resembling concentrates came into the raise. Several mine cars of this material were obtained. A bulkhead has been put in and new work is being done in the neighborhood with the expectation of reaching a solid orebody.

*Ohio Copper*—Concentrates running 27 per cent. copper have been made recently. The usual copper content has been in the neighborhood of 23 per cent.

## SUMMIT COUNTY

*Silver King Consolidated*—Instead of levying an assessment with which to carry on the development work, it has been decided to borrow \$50,000 by notes. Development has been actively carried on, on the 1550- and 1600-ft. levels. A new face of galena ore 2 to 3 ft. in thickness has been opened in a fissure on the 1550 level.

*Little Bell*—A mill will be built on the property. A part of the dump will be milled and also ore now stored in the mine.

## TOOELE COUNTY

*Boston-Sunshine*—On account of the inability to develop new ore reserves, the mine and mill will be closed when the cleanup in progress is completed. About 14 months ago, when the property was first operated, there was a year's supply of ore blocked out. The vein did not carry uniform workable values, and although much development was done to the north and south of the productive orebody, no new oreshoots were discovered. It is estimated that the present cleanup will bring in about \$8500, which will be used to pay the last dividend. This will make the total dividends amount to \$19,500. The Boston-Sunshine was a close corporation. The mill operations were successful, and made a good extraction on the low-grade gold ore.

## Washington

## FERRY COUNTY

*Keystone*—Operations will be resumed at this mine. D. A. Mills is owner.

*Tough Nut*—This mine, closed for eight years, will be reopened by Nelson Clark, of Berkeley, Cal., and Fred B. Ginnel. New machinery will be purchased.

*North San Poil*—A strike was made at this mine by Kerr & Krummer, of Republic. They expect to ship one car of ore a week.



### Wyoming

*United Smelters*—I. N. Pennock, of Cleveland, Ohio, has sent notice of a stock assessment to protect the property from foreclosure by bondholders.

### Canada

#### NOVA SCOTIA

#### *Dominion Steel and Coal Corporation*

—At an adjourned shareholders' meeting held at Montreal, June 23, it was finally decided that the name of the merger would be changed to "The Dominion Steel Corporation, Ltd.," the name previously selected "Canadian Steel Corporation" being discarded on account of its similarity to that selected by the Hamilton merger. President Plummer announced that the company has decided not to build new wire and nail mills at present. The wages of the company's mine and steel works employees have been advanced 5 per cent.

*Egerton Gold Mine*—This mine at Fourteen-Mile stream has been leased to James A. Fraser, of New Glasgow, and M. McLeod, of River John. The mine has a 10-stamp mill run by water power. It was formerly operated but has been closed for several years.

*Nova Scotia Steel and Coal Company*—President Robert E. Harris announces that the company is erecting two buildings at a cost of \$100,000, in connection with which many improvements will be adopted. One will be a modernized fire-proof shipping room, and the other a manufacturing building to embrace the spike, bolt and nut, rivet, shafting, machinery steel and straightening departments, at present scattered over the plant. The capacity in most of these lines will be considerably increased. The coal production on June 10 was 3532 tons, breaking the record by several hundred tons.

#### ONTARIO

The shipments from Cobalt for the week ended June 17 were: Kerr Lake, 586,000 lb.; Nipissing, 367,670; La Rose, 258,020; Chambers-Ferland, 116,400; McKinley-Darragh, 90,460; Crown Reserve, 86,000; Buffalo, 80,000; Cobalt Lake, 64,900; Temiskaming, 60,000; total, 1,709,450 pounds.

The Haileybury Frontier and Maidens companies at South Lorraine are putting in new plants.

*Nipissing*—Two new shaft houses are to be built, one on a number of veins bordering on the Chambers-Ferland, and the other probably in the Keewatin area on the edge of the Gillies Limit, where a rich vein was recently found.

*Cobalt Central*—A complaint alleging corporation irregularities has been filed in the U. S. Court at New York by H. M. Hitchings, attorney.

*Little Nipissing*—The Peterson Lake

Company has granted an extension of the lease for five years.

*Chambers-Ferland*—The annual report for the year ended May 15 shows a gross production of \$130,968 with net profits of \$47,278.

*Langham*—A discovery of native silver has been made on the surface in this Elk Lake mine.

*Goldfield Company*—A merger has been arranged between the Harris-Maxwell and Tournie companies of London Lake under this name. The capitalization is \$3,000,000, the stockholders in the two companies receiving share for share in the new concern. The 10-stamp mill on the Maxwell-Harris will be enlarged to 50 stamps.

*St. Anthony*—At this mine, Sturgeon Lake district, development has been recommenced with Capt. R. Sandoe in charge. Mining will be continued for a year before any milling is done.

### Mexico

The Southern Pacific is surveying a line to Manzanillo, from the present terminus of the Pacific Coast road in Tepic. This is given as confirmation that the company may abandon the Guadalajara connection and build instead to the Pacific port of Manzanillo.

#### CHIHUAHUA

*Rosario*—This property, in the north-western part of the State, at Guadalupe y Calvo, is under option to the West Mexican Mines Company, of London. A reduction plant will be erected.

#### DURANGO

*Mexico Consolidated*—A proposition to issue notes to cover the large indebtedness to the Stallforth interests, of Parral, has been turned down by the Boston stockholders. W. A. Mossman succeeds J. C. Fairchild on the board.

#### MEXICO

*La Quimica*—This Sultepec mine is under option to the Exploration Company of London. Robert Musgrave is in charge of the mine which will operate again.

*Esperanza*—The May return shows 16,712 tons crushed yielding \$193,471, leaving an operating profit of \$92,219.

#### PUEBLA

*Teziutlan*—The new furnaces are now in full operation. R. L. Lloyd is general superintendent.

#### SONORA

The Alamos district is the scene of great activity. Many prospects are being opened up and proving successful. At Sobia, 35 miles north of Alamos, the La Junta company is sacking ore running 6 oz. of gold per ton. Eight cars have been shipped producing about the same results. The lower grade ore is treated at the mine by cyanide. The Prieta, owned by Wilson & Obermuller, is showing up

equally well. The Santo Domingo company is erecting a 10-stamp mill and concentrating plant on the property, a good supply of water being assured.

*Cieneguita*—B. E. Marks has been appointed receiver at Phoenix, Ariz., for this company. The action is the outcome of long pending corporation troubles.

*Sonora United Mines*—This New York company is erecting hoist, boiler, pumps, etc., on the property, 80 miles east of Hermosillo. The main prospecting shaft is down 120 ft. where silver sulphide ore was struck. A. W. Christian is superintendent.

*San Juan Grande Consolidated*—This company has a 25-ton smeltery about completed, the first ore to be treated will come from the Mazatan company mines. The Amargossa is also anxious to have its ore treated locally. The plant is in the Mazatan district, 50 miles east of La Colorada.

*Juarez*—This mine, which has been worked profitably for several years, has closed indefinitely.

### Africa

#### TRANSVAAL

For the four months ended April 30 the output of metals other than gold in the Transvaal included 259,873 oz. silver; 1155 tons copper ore; 1260 tons tin ore. Other minerals in April included 55 tons magnesite, 336 tons flint, 14 tons asbestos, 4666 tons lime and 1,766,063 tons coal.

The accident report for the four months shows 42 whites, 269 negroes and two Chinese killed; a total of 313. The injured included 107 whites, 575 negroes and three Chinese; a total of 625 persons. This is an average of 1.28 killed and 2.56 injured per 1000 employees.

### Australia

#### QUEENSLAND

Gold production in May was 36,900 oz.; for the five months ended May 31 it was 176,834 oz., or \$3,655,159; an increase of \$422,415 over last year.

#### WESTERN AUSTRALIA

Gold production in May was 127,714 oz., or 2466 oz. more than in April. For the five months ended May 31 it was 649,550 oz. in 1909, and 608,893 oz.—or \$12,585,818—in 1910; a decrease of 40,657 oz. this year.

### South America

#### CHILE

*Braden*—Although the concentrator construction now under way at the Braden property is for a 2000-ton plant, it is believed the capacity will be at least 3000 tons daily. The company's railroad, which is to connect Rancagua, on the coast, with the mine, is 90 per cent. finished.

# THE MARKETS

Current Prices of Metal, Minerals, Coal and  
Stocks, Conditions and Commercial Statistics

## Coal Trade Review

*New York, June 29*—Coal trade in the East is quieter than usual at this season, when large consumers are generally buying their winter supplies. There is coal moving, but not in special quantities, and work at the mines is not generally active. There is some accumulation at tidewater, and demurrage sales are heard of now and then. In fact the trade generally is just dragging, but hoping for better things in the fall.

In the West, Illinois is the only unsettled point now, and the strike conditions there show no change. It looks as if there would be no end except through a gradual crumbling away on one side or the other. The Southwest has come to an agreement, as noted below.

The harvest which Indiana mines have been reaping from the Chicago trade, on account of the Illinois strike, is being broken into by the competition of Ohio and West Virginia coals, which are being sent forward pretty freely.

*Southwestern Wage Settlement*—A despatch from Kansas City announces the end of the strike in the Southwestern field—including Missouri, Kansas, Arkansas and Oklahoma. A conference was held in Kansas City, at which the delegates finally reached an agreement. Last week this was formally approved and signed by both operators and miners. It is for two years and provides that the mining scale shall be advanced 3c. per ton on run-of-mine, and 5c. on screened coal. They give up, however, some of their claims. The new scale takes effect July 1, when the miners return to work.

### COAL TRAFFIC NOTES

Coal tonnage of Norfolk & Western railway, 11 months of fiscal year from July 1 to May 31, short tons:

District:	Com- mercial.	Com pany.	Total.
Pocahontas.....	8,845,251	1,108,728	9,953,979
Tug River.....	1,336,376	221,956	1,558,332
Thacker.....	1,365,215	612,335	1,977,548
Kenova.....	663,717	167,718	771,435
Clinch Valley.....	620,521	52,991	673,512
Total.....	12,771,080	2,163,726	14,934,806

The total increase over the corresponding period in 1908-9 was 3,498,909 tons, or 30.6 per cent.

Receipts of domestic coal at San Francisco, four months ended April 30, were 98,871 long tons in 1909, and 112,867 in 1910; increase, 13,996 tons.

Coal passing Davis Island dam on the Ohio, four months ended April 30, was

1,756,345 short tons in 1909, and 897,130 in 1910; decrease, 859,215 tons.

Coal passing locks on the Monongahela above Pittsburg, four months ended April 30, was 3,206,720 short tons in 1909, and 2,911,100 in 1910; decrease, 295,620 tons.

Coal receipts at St. Louis, four months ended April 30, were 2,267,188 tons in 1909, and 3,130,879 in 1910; increase, 863,691 tons.

Coal and coke tonnage of Chesapeake & Ohio Railway, 10 months of fiscal year from July 1 to April 30, short tons:

	Coal.	Coke.	Total.
New River.....	6,404,027	304,338	6,708,365
Kanawha.....	5,490,206	52,319	5,542,525
Kentucky.....	466,005	228	466,833
Connecting lines.....	85,033	38,778	123,811
Total.....	12,645,871	395,663	13,041,534
Total, 1908-9.....	10,062,896	315,331	10,378,227

Total increase this year, 2,663,307 tons, or 25.7 per cent. Shipments this year to points west of mines, 6,708,921 tons coal and 191,247 coke; points east, 1,660,915 tons coal and 170,184 coke; tidewater, 4,268,224 tons coal and 34,232 coke; anthracite to line points, 7811 tons.

## New York

### ANTHRACITE

*June 29*—Current business is mainly on contracts with little new business going. There was no special rush to save the June discount.

On Friday 10c. comes off the summer discount and schedule prices will be \$4.55 for broken and \$4.80 for egg, stove and chestnut, all f.o.b. New York harbor points. For steam sizes, current quotations are: Pea, \$3@3.25; buckwheat, \$2.20@2.50; No. 2 buckwheat or rice, \$1.65@2; barley, \$1.35@1.50; all according to quality, f.o.b. New York harbor. The lower prices are usually for washery coals.

### BITUMINOUS

The market for the better grades of coal is unmistakably dull, though gas coal and the cheaper grades are being taken at a fair rate. The quiet extends all around and is seen in New England territory as well as elsewhere.

Prices continue low. Good gas coal has sold at a figure which realizes \$1 per ton at mine. There is beginning to be some accumulation of coal at the harbor receiving points, and some coal has been sold to save demurrage, at a price which makes about 60c. per ton at mine.

Car supply is good, and transportation fairly regular, so that coal comes through to tide freely and in good time.

In the coastwise trade vessels are not over plenty and freights are firm. From New York, rates are 75@80c. to points around Cape Cod. Large vessels from Philadelphia get 75c. to Boston, Salem and Portland; 65c. to Providence and the Sound.

## Birmingham

*June 27*—Alabama coal mines are being operated steadily and more labor is sought. There is apparently a demand for all the coal that can be mined and the railroads are furnishing all the transportation facilities that could be asked for. Consumption in the home territory is good, and there is a quantity of coal being shipped away. A resumption has been noted at some places where slack work has been on for several weeks. The Tennessee company is working every one of its mines and is also pushing work on further development. A number of coke ovens which have been running light, have also been put in on full time. The demand for coke has recently picked up.

## Chicago

*June 27*—General conditions in the local coal market remain about the same as last week. Needs of steam users apparently are being fully met from Indiana and other mines east of Illinois. Naturally, Indiana coal, as coming nearest to Illinois in quality and price, is preferred by most consumers. Smokeless and Hocking have not gained many new customers for the Indiana production has been and continues to be large enough to take care of the great number of consumers habitually using Illinois coal. It looks now as if the mines of Illinois might remain closed indefinitely, without causing any lack of a supply sufficient to keep going most if not all of the steam producers. Domestic coals are practically out of the market, even anthracite moving very lightly.

Prices continue to be nearly the same for one size as for another of Indiana coal, lump bringing \$2@2.10; run-of-mine, \$1.90@2.05, and screenings, \$2@2.10. Screenings, as heretofore, are in strongest demand. Eastern coals sell closely to circular prices, smokeless bringing \$3.55 for lump and \$3.15 for run-of-mine; Hocking, \$3.15, and Youghiogheny, \$3.22 for ¾-in. There is practically no surplus coal of any kind on tracks, though this seems due more to cautious, well regulated shipments from Eastern mines rather than to any greatly increased demand. Consumption of

steam coals is checked somewhat by the summer conditions, but is large and is not likely soon to become much smaller.

**Cleveland**

June 27—Lake trade is rather slow, and several coal carriers have been laid up for want of charters. In local business steam trade is steady, but the hot weather has wound up domestic trade for the present.

Middle district coal, f.o.b. Cleveland, is quoted at \$2 for 1¼-in.; \$1.85 for ¾-in.; \$1.75 for run-of-mine; and \$1.65 for slack. No. 8 and Cambridge districts, 15 or 20c. higher. Youghiogheny, \$2.45@2.50 for 1¼-in.; \$2.30@2.35 for ¾-in.; \$2.20@2.25 for run-of-mine; and \$1.80@1.85 for slack.

**Indianapolis**

June 27—Up until the past week Indiana coal mines were enjoying heavy business because of demands from districts under suspension which came to the Indiana field, the most convenient for the purpose, with the result that Indiana coal went up to a high price. Suddenly there has been a perceptible slump. The demand, or at least, a large part of it, stopped suddenly. It took a week to find out the cause. It is understood that the Illinois Manufacturers' Association, came to the conclusion that they were paying too much for their coal. Indiana prices continued to climb and they turned their attention to Ohio and West Virginia coals. This belief is strengthened by the fact that about the time the orders stopped coming to the Indiana field, coals from Ohio and West Virginia began arriving at Chicago and other manufacturing towns in deluges and were bought up readily, and at a price below that for which Indiana coals had been selling. Indiana operators claim that when all expenses on this Ohio and West Virginia coal are paid it costs the manufacturers more than Indiana coals. Notwithstanding the sudden break in orders, the Indiana mines are working full force and full time on orders already booked and will continue to do so for some weeks.

**Pittsburg**

June 28—The local demand for coal continues of good volume, and prices are well held. The Pittsburg Coal Company had the largest pay in its history on Saturday. Some easing up in demand may occur over Independence Day, but the labor supply is certain to run short at the same time. Lake shipments continue very heavy. We continue to quote: mine-run and nut, \$1.20@1.25; ¾-in., \$1.30@1.35; domestic, 1½-in., \$1.50; slack, 80@85c. per ton at mines.

**Connellsville Coke**—The market has been very quiet as to contracts for furnace coke. Several merchant-furnace in-

terests would contract for the half year at perhaps \$1.80@1.85, but they are furnaces now down and operators do not care to sell them, as they would only start in case there was a decided advance in the market. Some sales of prompt furnace coke have been made at \$1.65. Foundries which have contracts expiring this month are slow about renewing. The United Engineering and Foundry Company closed its contract, eight to 10 cars monthly for a year, at less than \$2.10, which means an extremely low price. At the other extreme we note a contract for a small tonnage for a year of exceptionally good foundry coke at \$2.50.

Some details have been rearranged in the merger of three lower Connellsville coke interests, a new name having been selected. An announcement may be made soon as to one or two other companies to join the merger, but on the whole there is no immediate prospect of any far reaching combination being put through.

We quote prices as follows, per net ton at ovens: Prompt furnace, \$1.65@1.70; contract furnace, \$1.75@1.85; prompt foundry, \$2.10@2.25; contract foundry, \$2.25@2.50 per ton.

The *Courier* reports the production in the Connellsville and lower Connellsville region in the week ended June 18 at 404,809 tons, a gain of 300 tons, and shipments at 4036 cars to Pittsburg, 6502 cars to points west and 879 cars to points east, a total of 11,417 cars.

**St. Louis**

June 27—The exceedingly hot weather has had the effect of easing up the demand for coal a great deal and the price has dropped about 10c. per ton all down the line. This is not caused by falling off in demand in St. Louis proper, as the call from steam plants and railroads here is still active, but a number of outside mines in Illinois and Indiana, which had depended on the retail demand throughout the country are now pouring their tonnage into St. Louis. Over 1,200,000 tons of coal have already been shipped into St. Louis this month, which is a heavier tonnage than ever before consumed here during June, so that it is really wonderful that prices are as good as they are. St. Louis, in fact, seems to be one of the best coal markets in the country at present.

The retail demand for coal is, of course, light, though a good deal of Pennsylvania anthracite is moving. Consumers are holding off buying soft coal as they all anticipate a drop in price later on. Retail prices are very good now, as Standard lump is bringing 14c. per bushel delivered, and Trenton or high-grade, 15c. The June retail price of hard coal is \$7.70 delivered, on egg, stove and chestnut, and \$7.45 on grate.

Wagon lot contracting is not progressing very rapidly, as the demand for teams is so good for work outside the coal business that a number of companies are hiring their teams out.

Current prices are as follows for the St. Louis market:

	Mine.	St. Louis.
<b>Illinois, Standard:</b>		
6-in. lump and egg.....	\$1.50	\$2.02
2-in. lump and nut.....	1.30	1.82
Mine-run.....	1.20	1.72
Screenings.....	1.25	1.77
<b>Trenton:</b>		
6-in. lump and egg.....	1.75	2.27
3-in. nut.....	1.50	2.02
<b>Staunton or Mt. Olive:</b>		
6-in. lump.....	1.70	2.22
2-in. nut.....	1.60	2.12
Mine-run.....	1.50	2.02
Screenings.....	1.50	2.02
<b>Pocahontas and New River:</b>		
Lump or egg.....	1.50	4.00
Mine-run.....	1.10	3.65
<b>Pennsylvania Anthracite:</b>		
Nut, stove or egg.....		6.65
Grate.....		6.40
<b>Arkansas Anthracite:</b>		
Egg or grate.....	3.35	5.35
<b>Coke:</b>		
Connellsville foundry.....		5.40
Gas house.....		4.50
Smithing.....		4.15

Bids for supplying the public buildings, schools, and other institutions, have been received and show considerable variation, running from \$1.55 up to \$2.04 for lump, delivered.

**FOREIGN COAL TRADE**

**German Coal Production**—Coal production of the German Empire, four months ended April 30, metric tons:

	1909.	1910.	Changes.
Coal.....	48,181,594	48,996,311	I. 814,717
Brown coal.....	21,842,382	21,798,625	D. 43,757
<b>Total mined..</b>	<b>70,023,976</b>	<b>70,794,936</b>	<b>I. 770,960</b>
Coke made.....	6,946,642	7,537,076	I. 590,434
Briquets made.	5,947,475	6,071,312	I. 123,837

Of the briquets reported this year 4,676,102 tons were made from brown coal or lignite.

**Welsh Coal Prices**—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of Welsh coal as follows, on June 17: Best Welsh steam, \$3.99; seconds, \$3.78; thirds, \$3.66; dry coals, \$3.72; best Monmouthshire, \$3.60; seconds, \$3.48; best steam smalls, \$2.04; seconds, \$1.74. All prices are per long ton, f.o.b. shipping port, cash in 30 days, less 2½ per cent. discount.

**IRON TRADE REVIEW**

**New York, June 29**—The iron and steel markets seem to be settling down into a quiet condition, which is not unusual in midsummer. There is a moderate volume of business, but little special activity.

In pig iron little is doing for early deliveries. In Eastern territory there are a good many inquiries for fourth-quarter deliveries, but furnaces are unwilling to take present prices for such deliveries.

and few contracts are closed. For nearer business there is a good deal of shading, especially by makers whose yards are full. Stocks of foundry iron are reported rather large, but little further curtailment of make is noted. Buyers seem to be hoping that the weight of unsold stocks will break down the present prices still further.

In finished material most lines are quiet. The best business is in structural steel. The contracts taken in June amounted to about 180,000 tons. Negotiations and inquiries are pending for about 150,000 tons more. On much of this it is believed that low prices will be made, 1.50c. down to 1.45c. being quoted on some contracts; this will doubtless be followed by others.

The Steel Corporation will not be investigated just now, the resolution offered in Congress for such a proceeding having been held back by the Rules Committee until the adjournment. The resolution asked for information to determine whether the corporation does not constitute a combination in restraint of trade contrary to the law.

**Structural Steel**—The American Iron and Steel Association gives the production of structural shapes in the United States in 1909 at 2,275,562 tons, the largest quantity ever reported. The totals for 10 years have been, in long tons:

1900	815,161	1905	1,660,519
1901	1,013,150	1906	2,118,772
1902	1,300,326	1907	1,940,352
1903	1,095,813	1908	1,083,181
1904	949,146	1909	2,275,562

These statistics do not include plates, girders made from plates, or bars for reinforcing concrete work. Plates and concrete bars are provided for under other classifications, and all plates cut to specifications are included in the general statistics of plates.

**Texas Iron Ore**—A cargo of iron ore from the mines at Jefferson, Texas, controlled by Charles M. Schwab and associates, arrived at Philadelphia, June 22. The cargo is 1700 tons, and the ore is to be tested in the blast furnace, probably at Bethlehem. This is the first shipment from the mines.

#### Baltimore

June 27—Exports during the week included 2,852,743 lb. structural and other steel and iron to Panama. Imports included 50 tons spiegeleisen, 2120 tons ferromanganese and 300 tons silicospiegel from Great Britain; 5200 tons iron ore from Spain; 32,000 tons iron ore from Cuba.

#### Birmingham

June 27—Furnace companies in the Southern territory sold about their make during the month of June, if not a little better. The manufacturers could have sold a large quantity of iron for delivery during the latter part of the year, had

there been an inclination to accept prices that were offered by consumers. While some iron was sold for immediate and third quarter delivery during the first part of June at \$11.50, or less, the price at present is \$12 for No. 2 foundry. Sales have been declined, it is stated on the best of authority, under \$12. The Shelby Iron Company will be making charcoal iron again before the end of another six days. Special brand, special analysis, basic and charcoal iron continue to command good prices. There is no delay in making shipments.

The home consumption is keeping apace with the record set some weeks since. The cast-iron pipe and machinery makers, the foundries and other consumers in home territory are losing no time.

#### Chicago

June 27—The iron market is very quiet, but there continues to be a fair aggregate volume of buying for the needs of the third and fourth quarters, with most melters preferring to buy in small lots for needs actually in sight within the next 30 to 90 days. The movement toward general buying for the last quarter has lulled, melters being encouraged to hold off from placing contracts by the reports of general overproduction of pig iron. With this belief current, the market naturally tends to revert to the buying of small lots for early delivery.

Southern No. 2 continues at \$11.50@12, Birmingham, which means \$15.85@16.35, Chicago. Northern remains at \$16.50@17 for No. 2. Lake Superior charcoal is steady at \$18.50@19 per ton.

Iron and steel products have a good sale, structural material especially showing activity. Coke is in fair demand, the best Connellsville bringing \$5. Little business in pig iron is being done for 1911 delivery, though melters are increasing their inquiries about first-quarter supplies. Furnace agents are holding to higher prices than those quoted for 1910 delivery, and make their lowest quotations on third-quarter delivery.

#### Cleveland

June 27—The ore market is flat. Shipments are decreasing and are limited to contract business. The movement is so slow that the independent vessel owners have decided to lay up some 40 boats, or about 20 per cent. of their tonnage. This action was resolved on at a meeting held recently in Cleveland.

**Pig Iron**—Inquiries are coming in, but few are resulting in sales. Offers of concessions have been made, which are expected to bring business. Bessemer is quoted \$16.65@16.90, Cleveland, with the lower figure most common. For No. 2 foundry, prices are \$15.25@16; all Cleveland delivery.

**Finished Material**—Not much new business is noted. On contracts that have been closed, some concessions are said

to have been quietly made. On iron bars there is sharp competition and prices at local mills are 1.37½@1.40 cents.

#### Philadelphia

June 29—Eastern makers of pig iron, with a few exceptions, have refused to lower quotations this week or to accept orders offered them below current rates. The exceptions to this rule are makers of certain brands from the interior of the State where makers are not allowing any small concession to lose them an order. During the past two or three weeks shipments of Virginia and Alabama iron have found their way into this territory; even this fact does not influence makers of good iron to yield. Gray forge has developed activity, as a number of plants had allowed their mills to run low in stocks, in the expectation of a break which has not materialized. Basic iron has sold better during the past week or two. As a rule there is very little anticipation of requirements. Fair brands of No. 2 X foundry have been sold within a few days at \$16.75, with gray forge \$1 lower and basic firm at \$16. Southern gray forge is being offered at \$15, or under.

**Steel Billets**—The only sales are of forging billets for immediate delivery.

**Bars**—A number of bar mills have been endeavoring to load up with business for the fall months at concessions from quoted rates but the inducements are not sufficient to bring about any departure from the established hand-to-mouth methods of doing business.

**Sheets**—Sales have fallen off chiefly because the larger consumers have enough stock to carry them along into the fall trade. The small distributors of sheet iron are buying constantly just enough to fill orders.

**Pipes and Tubes**—A heavy consumption in tubes is reported in large and small plants.

**Plates**—Heavy orders for plate are once more in sight because of the large amount of car business which has been placed. Prices have been shaded a trifle, but not on the ordinary business from the smaller concerns.

**Structural Material**—Large orders for structural material are on the market but most of the business will probably go to mills west of the mountains.

**Scrap**—Sales of scrap have been almost nothing, and prices are weak. The only sales noted are of wrought pipes and tubes and some heavy melting steel scrap.

#### Pittsburg

June 28—While the iron and steel market is generally regarded as stagnant, the fact is that the tonnage keeps up very well, pig iron, crude steel and finished-steel production being almost as heavy at the close as at the opening of the month. That the industry is able to

maintain so large a tonnage, when general sentiment is unfavorable and no one is taking material except for absolute requirements, furnishes a favorable augury for the future.

There will be less closing of iron and steel plants in July than was expected. Most of the iron mills will close, with a few of the steel plants, but on the whole, only a very small percentage of the operations will show any interruption.

A wage-scale conference is being held at Detroit between the Western Bar Iron Association and the Amalgamated Association, but a settlement at this time is improbable. Later it is likely the local mills which recognize the Sons of Vulcan will meet that organization. Both unions have demanded stiff wage advances, which are not at all likely to be granted.

There is a fairly good demand for wire products, considering the season, and buying in June has been slightly better than in May. Prices are held well at the concession established two or three months ago of \$1 a ton from the nominal prices of \$1.85 on nails and 1.65c. on plain wire. Plates and shapes continue rather soft, 1.40c. being possible on desirable orders.

**Pig Iron**—Scattered sales of foundry iron have been made in the local market, aggregating perhaps 6000 or 7000 tons in the week, at about \$14.50, Valley, for No. 2. Inquiries aggregating 35,000 tons of bessemer, basic and malleable have been withdrawn, this including 12,000 tons of standard bessemer and malleable asked for by the Oliver Chilled Plov Works, for second half, about 18,000 tons of basic asked for by the Colonial Steel Company for the year beginning July 1, and one or two smaller lots. The market is quotable unchanged as follows: Bessemer, \$15.75; basic, \$14.75; No. 2 foundry, \$14.50; forge, \$13.75; malleable, \$15, all at Valley furnaces, freight to Pittsburg being 90c. It is possible that these prices could be shaded, but on the other hand they could not be done for delivery to the end of the year.

**Ferromanganese**—The market continues quiet and prices are not strong. We quote \$39.50 for prompt and \$40@40.50 for forward deliveries, f.o.b. Baltimore, freight to Pittsburg being \$1.95 per ton.

**Steel**—Inquiry for billets is light, but there is considerable negotiating for sheet bars, mills being somewhat slow to close on the latter, as they are striving earnestly to develop lower prices. The market is not quotably changed: Bessemer billets, \$25@25.50; sheet bars, \$26@26.50; open-hearth billets, \$28@28.50; sheet bars, \$28.50@29, all f.o.b. maker's mill, Pittsburg or Youngstown districts. Wire rods are easier, at \$30.50@31 per ton.

**Sheets**—An agreement was reached late last Wednesday night between a committee representing 12 of the 15 independent sheet and tinplate producers who have hitherto signed the scale, and the wage committee of the Amalgamated Association, to sign the existing scale for another year. The three concerns not represented will likely sign also. The demand for a 10 per cent. advance was probably not made with the expectation that it would be granted. The 15 concerns have 65 tin and 74 sheet mills, there being approximately 81 independent tin and 136 independent sheet mills which are nonunion, while the leading interest, with 235 tin and 184 sheet mills, has been nonunion for a year. The sheet market shows only moderate activity, and the concessions of about \$2 a ton are being made by a larger number of mills than formerly. Nominal prices are 2.40c. on black and 3.50c. on galvanized sheets, with \$1.70 for painted corrugated roofing and \$3 for galvanized.

**St. Louis**

**June 27**—The pig-iron market shows no improvement. Practically no interest at all is being shown by consumers in buying for any time at any price. This seems strange, as the demand for finished products is good and all foundries are running full. Prices remain unchanged at \$12 per ton, Birmingham or \$15.75, St. Louis.

**Sault Ste. Marie Canal**

The total freight passing through the Sault canals for the season up to June 1 was, in short tons:

	1909.	1910.	Changes.
East-bound.....	3,845,433	8,095,083	I. 4,249,650
West-bound.....	1,339,529	2,392,116	I. 1,052,587
Total.....	5,184,962	10,487,199	I. 5,302,237

The total number of vessel passages this year was 3626, showing an average cargo of 2892 tons. Mineral freights included in the totals were as follow, in short tons except salt, which is given in barrels:

	1909.	1910.	Changes.
Coal.....	1,096,860	2,046,266	I. 949,406
Iron ore.....	3,028,609	6,992,650	I. 3,964,041
Pig and man. iron.....	65,000	94,703	I. 29,703
Copper.....	21,613	22,202	I. 589
Building stone.....	450	.....	D. 450
Salt, bbl.....	164,340	159,143	D. 5,197

Iron ore this year was 66.7 per cent. and coal 19.5 per cent. of the total freight.

**FOREIGN IRON TRADE**

**Belgian Iron Production**—The make of pig iron in Belgium for the five months ended May 31 was: Foundry iron, 37,540; forge iron, 85,460; bessemer and basic pig, 630,220; total, 753,220 metric tons, an increase of 151,270 tons over last year.

**British Iron Ore Imports**—Imports of iron ore into Great Britain, five months ended May 31, were 2,345,119 tons in 1909 and 1,109,788 tons in 1910; an increase of 764,669 tons.

**METAL MARKETS**

**New York, June 29**—The metal markets continue without much change and no improvement in prices, though a fair business has been done in some lines.

**Gold, Silver and Platinum**

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
<b>Gold:</b>			
May 1910..	\$ 717,678	\$ 3,143,338	Imp.\$ 2,425,660
" 1909..	11,171,265	2,263,721	Exp. 8,907,544
Year 1910..	47,917,384	14,812,614	" 33,104,770
" 1909..	55,487,891	17,767,857	" 37,720,034
<b>Silver:</b>			
May 1910..	4,170,754	3,354,715	Exp. 816,039
" 1909..	4,428,848	3,857,388	" 571,060
Year 1910..	22,506,835	18,593,349	" 3,913,486
" 1909..	23,854,629	18,532,753	" 5,321,876

Exports from the port of New York, week ended June 25: Gold, \$6455; silver, \$1,161,210, chiefly to London and Paris. Imports: Gold, \$118,080, chiefly from South America; silver, \$76,129, chiefly from Central America.

Foreign trade of the United States four months ended May 31, as valued by the Bureau of Statistics, Department of Commerce and Labor:

Merchandise:	1909.	1910.
Exports.....	\$ 670,553,581	\$ 676,933,703
Imports.....	593,332,163	680,646,070
Excess.....	E.\$ 77,221,418	I. \$ 3,712,367
Deduct excess of exports, silver.....		3,913,486
Deduct excess of exports, gold.....		33,104,770
Net export balance.....		\$ 33,305,889

The gold and silver movement in detail will be found in the table above.

Exports of silver from London to the East from Jan. 1 to June 16, reported by Messrs. Pixley & Abell:

	1909.	1910.	Changes.
India.....	£2,599,400	£2,749,500	I. £ 150,100
China.....	1,075,100	1,113,500	I. 38,400
Straits.....	82,800	.....	D. 82,800
Total.....	£3,757,300	£3,863,000	I. £ 105,700

India Council bills in London brought an average of 15.94d. per rupee for the week. Messrs. Pixley & Abell write: "China still holds aloof from the London market and business is reported as almost at a standstill, the speculation in rubber shares being again mentioned as a disturbing factor."

**Gold**—There has been no special demand, and the price on the open market in London was 77s. 9d. per oz. for bars and 76s. 5d. per oz. for American coin.

**Platinum**—The market is rather quiet, but firm. Dealers ask \$32 per oz. for refined platinum and \$37 per oz. for hard metal.

SILVER AND STERLING EXCHANGE

June.	23	24	25	27	28	29
New York....	53 3/4	53 1/2	53 3/4	53 1/2	53 3/4	53 1/2
London.....	24 1/2	24 1/4	24 1/2	24 1/4	24 1/2	24 1/4
Sterling Ex..	4.8645	4.8610	4.8625	4.8630	4.8630	4.8615

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

**Silver**—The market continues remarkably steady with no new features. The

price is sustained chiefly by Indian bazaar buying.

Gold and silver movement in Great Britain five months ended May 31:

	Imports.	Exports.	Excess.
Gold .....	\$26,526,153	£20,171,745 Imp.	\$6,354,408
Gold, 1909...	24,264,465	17,896,757 Imp.	6,367,708
Silver .....	5,513,049	5,624,343 Exp.	111,294
Silver, 1909.	5,193,919	5,345,605 Exp.	151,686

Copper, Tin, Lead and Zinc

June.	Copper.			Tin.	Lead.		Zinc.
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	St. Louis, Cts. per lb.
23	12 5/8 @12 3/4	12 1/2 @12 1/4	54 3/4	32 3/4	4.32 @4.35	4.20 @4.22	4.95 @4.97
24	12 5/8 @12 3/4	12 1/2 @12 1/4	55 1/8	32 3/4	4.32 @4.35	4.20 @4.22	4.95 @4.97
25	12 5/8 @12 3/4	12 1/2 @12 1/4	....	32 3/4	4.32 @4.35	4.20 @4.22	4.95 @4.97
27	12 5/8 @12 3/4	12 1/2 @12 1/4	54 1/2	32 3/4	4.32 @4.35	4.22 @4.25	4.95 @4.97
28	12 5/8 @12 3/4	12 1/2 @12 1/4	54 3/4	32 3/4	4.32 @4.35	4.22 @4.25	4.95 @4.97
29	12 5/8 @12 3/4	12 1/2 @12 1/4	54 7/8	32 3/4	4.32 @4.35	4.22 @4.25	4.95 @4.97

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 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**—There has not been much to encourage buying during the last seven days, but nevertheless, a good deal of business has been transacted, owing to the fact that manufacturers' supplies are now very low and have to be replenished. Production at the refineries has been somewhat interfered with by the hot weather, and reports from Europe are to the effect that consumption over there is good and that manufacturers there are also poorly covered. At the close, Lake copper is quoted at 12 5/8 @12 3/4c. and electrolytic copper in cakes, wirebars and ingots at 12 1/2 @12 3/8c. Casting copper is quoted nominally at 12 @12 1/4 cents.

Copper sheets are 18 @19c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire has been reduced 1/4c. and is now 14c. base, carload lots at mill.

The London market for standard copper has been a dragging one, and without special feature. It closes at £54 8s. 9d. for spot, and £55 3s. 9d. for three months.

Refined and manufactured sorts we quote: English tough, £58; best selected, £59 @59 10s.; strong sheets, £67 @68 per ton.

Exports of copper from New York for the week were 5865 long tons. Our special correspondent gives the exports from Baltimore at 2801 tons.

**Tin**—Speculation seems to be entirely absent from the London market, judg-

ing from the small transactions and insignificant price changes during the past week. There was a fairly good sized buying of spot tin by dealers in this market—no doubt to even up engagements for June delivery. Consumers are still abstaining from buying future deliveries and are covering their requirements from hand to mouth. The London market closes steady at £148 15s. for spot and £149 15s. for three months, and New York at 32 3/8c. for spot.

**Lead**—The market is quiet and unchanged at 4.22 1/2 @4.25c., St. Louis, and 4.32 1/2 @4.37 1/2c., New York.

The London market for Spanish lead is unchanged at £12 15s., and for English lead at £12 17s. 6d. per ton.

**Spelter**—The market is quiet, and the few orders that present themselves are eagerly competed for. It is reported that the galvanizing business has fallen off somewhat, but there has been some demand for prompt shipment. At the close, St. Louis is quoted at 4.95 @4.97 1/2c., and New York at 5.10 @5.12 1/2 cents.

New York quotations for spelter June 23-29 were 5.10 @5.12 1/2 cents.

The London market for good ordinaries is higher at £22 15s., with £23 quoted for specials.

Base price of zinc sheets is \$7.50 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

**Aluminum**—The market is still quiet and prices are a shade lower. We quote No. 1 ingots at 23 1/4c. per lb., New York delivery. The foreign market is reported a little easier than it has been.

**Antimony**—The market remains quiet. Cookson's is quoted at 8.15 @8.20c. per lb. Other prices are 7 7/8 @8c. for U. S.; 7 3/4 @7 1/2c. for outside brands.

**Quicksilver**—New York quotations are \$47 per flask of 75 lb. for large orders; \$48 @49 for jobbing lots. San Francisco, \$46 @46.50 for domestic orders and \$2 less for export. The London price is £8 15s. per flask, with £8 12s. 6d. quoted by jobbers. Business is rather quiet.

**Nickel**—Large lots, contract business, 40 @45c. per lb. Retail spot, from 50c. for 500-lb. lots, up to 55c. for 200-lb. lots. The price for electrolytic is 5c. higher.

**Magnesium**—The price of pure metal is \$1.50 per lb. for 100-lb. lots, f.o.b. New York.

**Cadmium**—Current quotations are 65 @70c. per lb. in 100-lb. lots at Cleveland, Ohio.

Spanish Metal Exports

Exports of metal and mineral from Spain, four months ended April 30, reported by *Revista Minera*, in metric tons:

	1909.	1910.	Changes
<b>Metals.</b>			
Pig and manuf. iron	19,429	17,310	D. 2,119
Copper	6,007	4,647	D. 1,360
Copper precipitate	5,811	5,162	D. 649
Lead	51,752	59,492	I. 7,740
Zinc	816	646	D. 170
Quicksilver	631	825	I. 194
<b>Minerals.</b>			
Iron ore	2,488,033	3,062,733	I. 574,700
Manganese ore	1,650	2,482	I. 832
Copper ore	381,650	312,331	D. 69,319
Lead ore	974	1,190	I. 216
Zinc ore	40,431	45,790	I. 4,359
Pyrites, iron	431,011	436,609	I. 5,598
Salt	190,878	170,216	D. 20,662

Imports of phosphates, 33,995 tons in 1909, and 41,640 in 1910; nitrate of soda, 17,048 in 1909, and 19,614 tons this year.

Zinc and Lead Ore Markets

**Joplin, Mo., June 25**—The highest price paid for zinc sulphide ore was \$44 per ton, the base, \$38 @40 per ton, of 60 per cent. zinc. Zinc silicate sold as high as \$27 per ton on a base of \$20 @24 per ton of 40 per cent. zinc. The average price, all grades of zinc, was \$37.38. Lead prices continue unchanged at \$49, with the usual deductions for each 1 per cent. under 80 per cent. grades. The average price, all grades of lead, was \$48.76 per ton.

The record lead shipment of the year was made this week, indicating that producers who have been holding large quantities no longer expect a higher mar-

SHIPMENTS, WEEK ENDED JUNE 25.

	Zinc, lb.	Lead lb.	Value.
Webb City-Carterville	4,295,010	1,424,100	\$116,395
Joplin	1,877,610	296,970	45,665
Alba-Neck	677,390	8,800	14,336
Granby	961,030	1,000	13,704
Galena	497,960	154,840	13,216
Oronogo	607,550	540	11,638
Miami	214,860	325,870	10,265
Duenweg	362,830	144,980	10,072
Spurgeon	150,410	235,070	8,777
Aurora	450,340	48,980	8,042
Badger	346,700	.....	6,934
Sarcozie	257,820	.....	3,156
Carl Junction	205,960	14,070	4,566
Carthage	121,490	.....	2,490
Quapaw	49,220	2,230	988
Reeds	47,230	.....	469
<b>Totals</b>	<b>11,123,410</b>	<b>2,657,450</b>	<b>\$272,713</b>

Six months	285,219,150	42,664,480	\$6,812,216
Six mos. last year	293,631,420	45,709,640	6,668,626
Zinc value, the week	\$207,908	6 mos.,	\$5,705,088
Lead value, the week	64,805	6 mos.,	1,107,128

MONTHLY AVERAGE PRICES

Month.	ZINC ORE.				LEAD ORE.	
	Base Price.		All Ores.		All Ores.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	\$41.25	\$47.31	\$38.46	\$45.16	\$52.17	\$56.99
February	36.94	40.69	34.37	39.47	50.50	53.64
March	37.40	43.60	34.71	39.71	50.82	51.26
April	38.63	41.00	37.01	39.33	55.63	49.72
May	40.06	40.19	37.42	37.51	56.59	48.16
June	44.15	.....	40.35	.....	57.52	.....
July	43.06	.....	41.11	.....	53.74	.....
August	48.25	.....	44.54	.....	57.60	.....
September	47.70	.....	44.87	.....	56.11	.....
October	49.50	.....	45.75	.....	55.02	.....
November	51.31	.....	48.29	.....	53.94	.....
December	49.45	.....	47.57	.....	55.26	.....
<b>Year</b>	<b>\$43.98</b>	<b>.....</b>	<b>\$41.20</b>	<b>.....</b>	<b>\$54.60</b>	<b>.....</b>

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.

ket, or must of necessity market their holdings. It is estimated there are between 1000 and 1500 tons of this mineral still in bins in this district.

The receipt of information this evening that two blocks of the zinc-smelting works at Cherryvale are on dead fire, two at Neodesha are out of commission and one each at Caney and Deering have been blown out, indicates a reduction of approximately 650 tons decrease in the demand for zinc ore.

Platteville, Wis., June 25—The highest price paid this week for zinc ore was \$42.50 per ton; the base price, 60 per cent. zinc, was \$40@41. The base price paid for 80 per cent. lead ore was \$49@50 per ton.

SHIPMENTS, WEEK ENDED JUNE 25.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Highland.....	498,100	.....	.....
Galena.....	408,360	.....	.....
Platteville.....	393,100	.....	212,800
Cuba City.....	174,340	.....	348,000
Benton.....	85,400	.....	.....
Shullsburg.....	.....	128,000	.....
Total.....	1,559,300	128,000	560,800
Year to date.....	40,421,596	3,310,939	9,694,805

In addition to the above there was shipped during the week to the separating plants, 3,374,355 lb. zinc concentrates.

Other Ore Markets

Iron Ore—Current quotations for Lake Superior ores, on dock at Lake Erie ports, are: Bessemer ore—base 55 per cent. iron and under 0.45 phosphorus—\$5 per ton for Old Range and \$4.75 for Mesabi; nonbessemer—base 51.5 per cent. iron—\$4.20 for Old Range and \$4 for Mesabi.

In the East there is no organization of sellers, and a wide range of prices exists, according to quality and location of mines. A good nonbessemer ore, around 50 or 55 per cent. iron, can be had at \$3@3.50 per ton, f.o.b. mines; but no general quotations can be given.

Manganese Ore—The base price, as fixed by the large buyers, is 25c. per unit for manganese and 5c. per unit for iron content, for a base ore containing 49 per cent. or over in manganese, not over 0.20 phosphorus and 8 per cent. silica. Prices range down to 23c. per unit for 40 per cent. manganese; with deductions for excess of phosphorus and silica.

Zinc Ore—For Rocky Mountain blende, delivered at Kansas smelting points, the current price is for the zinc content, less eight units, at the St. Louis price for spelter, less \$14@15 per 2000 lb. of ore, according to quality, especially as to iron and lead content. See also Joplin and Wisconsin ore markets.

Pyrites—Domestic furnace sizes fetch 11@11½c. per unit, delivered at eastern acid works; fines, 10¾@11c. Pyrites containing arsenic realize from ½@1½c. per unit less.

Tungsten Ore—Ferberite, wolframite and huebnerite ores, \$6.50@7 per unit per ton of 2000 lb. for ore containing 60 per cent. of tungsten trioxide. For scheelite ores, 50c@\$1.50 per unit less.

CHEMICALS

New York, June 29—Deliveries on contracts continue steady, but outside of that business in chemicals is rather quiet.

Copper Sulphate—Business is fair and prices unchanged at \$4 per 100 lb. for carload lots and \$4.25 per 100 lb. for smaller parcels.

Arsenic—Business is not active, sales being about 100 tons for the week. Prices are again a shade lower, \$2.25@2.35 per 100 lb. being quoted for white arsenic.

Nitrate of Soda—Business is rather quiet, as usual at this season. Spot nitrate has firmed up a little, sales having been made at 2.10c. per lb. Futures are unchanged, at 2.10c. per lb. for all positions.

Petroleum

The following statement of pipe-line runs, deliveries and stocks in May is compiled by the Oil and Gas Journal; figures are in barrels of 42 gal. each:

Field:	Production.	Deliveries.	Stocks, June 1.
Pennsylvania.....	2,871,971	6,160,868	16,901,416
Illinois.....	2,389,993	946,346	29,125,028
Mid-Continent.....	4,619,240	4,365,912	55,915,030
Gulf Coast.....	1,174,063	1,002,811	5,971,334
California.....	7,098,884	5,000,000	23,500,000
Total.....	18,154,151	17,475,987	131,512,808

As compared with April, there was an increase of 835,616 bbl. in production, and a decrease of 821,711 bbl. in deliveries.

MINING STOCKS

New York, June 29—The general stock markets have been weak and only moderately active. On comparatively small sales prices have shown generally a downward tendency. There has been no apparent effort to support the market in any quarter.

On the Curb business was also slow. Most of the copper stocks sold off fractionally. Cobalt shares were fairly active, with only small changes in prices. Goldfield Consolidated was the most active stock on the market and held up well. Other Nevada stocks were not active.

Sales of securities at auction in New York, June 23, included 8 shares United States Steel common at \$77 per share; 10 shares Amalgamated Copper, \$64.75 per share; 79 shares Yukon Gold, \$4.18¾ per share; 18 temporary certificates Yukon Gold, \$3.62½ per share; 50 shares Balaklala Copper, \$5 for the lot; 1000 shares Great Cariboo Mining, 14c. per share; 100 shares. Greene Consolidated Gold and a participation certificate Mitchell

Mining Company, \$7 for the lot; \$2000 Passaic Steel first-mortgage bonds, \$180 for the lot.

Boston, June 28—There is little or no interest in copper shares. Naturally prices are weak as there is nothing in the situation to warrant any immediate improvement. A further indication of the times is the reduction in the Osceola Mining semi-annual dividend rate from \$6 to \$4. This had been expected, so that nothing unfavorable came as a result.

Butte & Ballaklava directors declared an initial dividend of 50c. for the quarter,

COPPER PRODUCTION REPORTS. Copper contents of blister copper, in pounds.

Company.	March.	April.	May.
Arizona, Ltd.....	2,886,000	2,340,000	2,610,000
Balaklala.....	1,263,733	1,109,311	1,148,762
Boleo (Mexico).....	2,148,383	2,777,800	2,735,680
Copper Queen.....	10,809,488	9,920,000	.....
Calumet & Ariz.....	2,820,000	2,400,000	1,778,000
Cananea (Mexico).....	3,700,000	4,262,000	.....
Detroit.....	1,698,975	1,930,000	.....
Imperial.....	825,000	800,000	.....
Nevada Con. (Est.).....	5,339,466	5,500,000	5,500,000
Old Dominion.....	2,674,000	2,325,000	2,174,000
Shannon.....	1,468,000	1,288,000	1,326,000
Superior & Pitts.....	2,370,000	2,130,000	2,276,000
Utah Copper Co.....	7,853,288	7,902,643	.....
Butte District.....	24,000,000	25,000,000	24,850,000
Lake Superior.....	19,250,000	16,250,000	19,250,000
Total production.....	89,366,867	86,934,754	.....
Imports, bars, etc.....	20,178,202	21,180,336	.....
Imp. in ore & matte.....	6,181,476	12,527,371	.....
Total.....	115,726,545	120,642,521	.....

Butte district and Lake Superior figures are estimated; others are reports received from companies. Imports duplicate production of Cananea, and that part of Copper Queen production which comes from Nacozari. Boleo copper does not come to American refiners. Utah Copper report from February includes the output of the Boston mill.

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
VI, 1909.....	116,567,493	60,591,116	70,966,457
VII.....	118,277,608	75,520,083	75,018,974
VIII.....	120,597,234	59,614,207	48,382,704
IX.....	118,023,139	52,105,955	50,077,777
X.....	124,657,709	66,359,617	56,261,238
XI.....	121,618,369	66,857,873	55,266,595
XII.....	117,928,655	69,519,501	59,546,570
Year.....	1,405,409,066	705,051,591	680,942,620
I, 1910.....	116,547,287	78,158,387	81,691,672
II.....	112,712,493	66,618,322	37,369,518
III.....	120,067,467	62,344,818	40,585,767
IV.....	117,477,639	67,985,951	31,332,434
V.....	123,242,476	59,305,222	45,495,400

VISIBLE STOCKS.

	United States.	Europe.	Total.
VI, 1909.....	169,848,141	127,352,960	297,201,101
VII.....	154,858,061	150,928,960	305,787,021
VIII.....	122,596,607	171,492,160	294,088,767
IX.....	135,196,930	197,993,600	333,190,530
X.....	151,472,772	210,224,000	361,696,772
XI.....	153,509,626	222,566,400	376,076,026
XII.....	153,008,527	236,857,600	389,866,127
I, 1910.....	141,766,111	244,204,800	385,970,911
II.....	98,463,339	248,236,800	346,700,139
III.....	107,187,922	254,150,400	361,338,322
IV.....	123,824,874	249,625,600	373,450,474
V.....	141,984,159	246,870,400	388,854,559
VI.....	160,425,973	239,142,400	399,568,373

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

but even this had been discounted and so was not felt marketwise. North Butte made a new low record at \$23.50 today but this is not surprising as things go.

Another low record is the price of Amalgamated Copper shares, at the close \$60 per share—a decline of some \$5 during the week.

Curb prices have also been weak, with a minimum of business. Both Rhode Island Coal and Massachusetts Coal are materially lower. Davis-Daly and Ohio continue under pressure while Chino continues to be absorbed at the lower level of prices now in vogue.

Mexico Consolidated reached a low at 75c., against a high a year or two ago at \$15. This company has had a somewhat uncertain career, although it has paid dividends. A stockholders' committee is now investigating the company's affairs.

**Assessments**

Company.	Delinq.	Sale.	Amt.
Alameda, Ida.	June 10	July 2	\$0.00
Alta, Nev.	July 4	July 29	0.03
Amador, Ida.	Feb. 24	June 30	0.01
Belcher, Nev.	July 4	July 29	0.10
Butte-Alex-Scott	July 1		1.00
Caledonia, Nev.	June 17	July 8	0.10
Central Eureka, Nev.	June 12	July 16	0.02
Chollar, Nev.	July 3	July 29	0.10
Crown Point, Nev.	June 26	July 20	0.10
Davis-Daly, Mont.	July		0.50
Davis-Daly, Mont.	Sept.		0.50
Gould & Curry, Nev.	July 17	Aug. 10	0.10
Hancock Con., Mich.	Aug. 10		3.00
Justice, Nev.	June 25	July 19	0.03
May Day, Utah.	July 15		0.02
Ophir, Nev.	July 4	Aug. 2	0.25
Reindeer, Ida.	May 31	Aug. 1	0.00
Rhode Island Copper, Mich.			0.50
Scottish Chief, Utah.			0.01
Sierra Nevada, Nev.	June 21	July 12	0.10
Yankee Cons., Utah.	June 24	July 14	0.02
Yellow Jacket, Nev.	June 9	July 11	0.15

**Monthly Average Prices of Metals SILVER**

Month.	New York.		London.	
	1909.	1910.	1909.	1910.
January	51.750	52.375	23.843	24.154
February	51.472	51.534	23.706	23.794
March	50.468	51.454	23.227	23.690
April	51.428	53.221	23.708	24.483
May	52.905	53.870	24.343	24.797
June	52.538		24.166	
July	51.043		23.519	
August	51.125		23.588	
September	51.440		23.743	
October	50.923		23.502	
November	50.703		23.351	
December	52.226		24.030	
Total	51.502		23.706	

New York, cents per fine ounce; London, pence per standard ounce.

**COPPER.**

	NEW YORK.				London.	
	Electrolytic		Lake.		1909.	1910.
	1909.	1910.	1909.	1910.		
January	13.893	13.620	14.280	13.870	61.198	60.923
February	12.949	13.332	13.295	13.719	57.688	59.388
March	12.387	13.255	12.826	13.586	56.231	59.214
April	12.561	12.733	12.931	13.091	57.363	57.238
May	12.893	12.550	13.238	12.885	59.338	56.313
June	13.214		13.548		59.627	
July	12.880		13.363		58.556	
August	13.007		13.296		59.393	
September	12.870		13.210		59.021	
October	12.700		13.030		57.551	
November	13.125		13.354		58.917	
December	13.298		13.647		59.906	
Year	12.962		13.335		58.732	

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling per long ton, standard copper.

**TIN AT NEW YORK**

Month.	1909.	1910.	Month.	1909.	1910.
January	28.060	32.700	July	29.125	
February	28.290	32.920	August	29.966	
March	28.727	32.468	September	30.293	
April	29.445	32.976	October	30.475	
May	29.225	33.125	November	30.859	
June	29.322		December	32.913	
			Av. Year	29.725	

Prices are in cents per pound.

**LEAD**

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	4.175	4.700	4.025	4.582	13.113	13.650
February	4.018	4.613	3.868	4.445	13.313	13.328
March	3.986	4.459	3.835	4.307	13.438	13.063
April	4.168	4.376	4.051	4.225	13.297	12.641
May	4.287	4.315	4.214	4.164	13.225	12.550
June	4.350		4.291		13.031	
July	4.321		4.188		12.563	
August	4.363		4.227		12.475	
September	4.342		4.215		12.781	
October	4.341		4.215		13.175	
November	4.376		4.252		13.047	
December	4.566		4.459		13.125	
Year	4.273		4.153		13.049	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

**SPELTER**

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	5.141	6.101	4.991	5.951	21.425	23.350
February	4.889	5.569	4.739	5.419	21.562	23.188
March	4.757	5.637	4.607	5.487	21.438	23.031
April	4.965	5.439	4.815	5.289	21.531	22.469
May	5.124	5.191	4.974	5.041	21.975	22.100
June	5.402		5.252		22.000	
July	5.402		5.252		21.969	
August	5.729		5.579		22.125	
September	5.796		5.646		22.906	
October	6.199		6.043		23.200	
November	6.381		6.231		23.188	
December	6.249		6.099		23.094	
Year	5.503		5.352		22.201	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

**PRICES OF PIG IRON AT PITTSBURG.**

	Bessemer.		Basic.		No. 2 Foundry.	
	1909.	1910.	1909.	1910.	1909.	1910.
	January	\$17.18	\$19.90	\$16.40	\$17.96	\$16.26
February	16.73	18.96	16.09	17.21	15.90	17.38
March	16.40	18.53	15.84	16.93	15.62	17.00
April	15.79	18.28	15.05	16.84	15.06	16.75
May	15.77	17.10	15.02	15.94	15.08	16.18
June	16.13		15.84		15.63	
July	16.40		15.90		15.96	
August	17.16		16.17		16.20	
September	18.44		16.80		17.03	
October	19.75		17.84		18.02	
November	19.90		18.37		18.09	
December	19.90		18.15		17.90	
Year	\$17.46		\$16.46		\$16.40	

**STOCK QUOTATIONS**

COLO. SPRINGS June 28			SALT LAKE June 28		
Name of Comp.	Bid.		Name of Comp.	Cig.	
Listed:			Carisa		.50
Acacia	.05		Colorado Mining		.46
Cripple Cr'k Con.	.02		Columbus Con.		.52
C. K. & N.	.18		Daly Judge		3.50
Doctor Jack Pot.	.09		Grand Central		1.32
Elkton Con.	.80		Iron Blossom		.79
El Paso	.85		Little Bell		1.10
Fannie Rawlins	.05		Little Chief		.45
Findlay	.08		Lower Mammoth		.26
Gold Dollar	.15		Mason Valley		6.80
Gold Sovereign	.03		Maj. Mines		.58
Isabella	.19		May Day		.01
Mary McKinney	.58		Nevada Hills		1.72
Pharmacist	.03		New York		.13
Portland	1.18		Prince Con		.69
Vindicator	.97		Red Warrior		6.00
Work	.03		Silver King Coal'n		2.27
Unlisted:			Sioux Con.		.23
Golden Cycle	1.50		Uncle Sam		.26
United Gold Mines	.08		Victoria		1.07

**SAN FRANCISCO. June 28.**

Name of Comp.	Cig.	Name of Comp.	Cig.
<b>COMSTOCK STOCKS</b>		<b>MISC. NEVADA</b>	
Atlanta	.11	Belmont	3.56
Belcher	.60	Daisy	.05
Best & Belcher	.49	Jim Butler	.28
Caledonia	.41	MacNamara	.26
Challenge Con.	.17	Midway	.26
Chollar	.10	North Star	.06
Confidence	.72	West End Con.	.53
Con. Cal. & Va.	.90	Atlanta	.10
Crown Point	.70	Booth	.14
Exchequer	.20	C.O.D. Con.	.07
Gould & Curry	.16	Columbia Mt.	.05
Hale & Norcross	.26	Comb. Frac.	.52
Mexican	1.07	Great Bend	.02
Ophir	.83	Jumbo Extension	.25
Overman	.55	Oro	.06
Potosi	.40	Red Hill	.03
Savage	.21	Sandstorm	.02
Sierra Nevada	.27	Silver Pick	.06
Union	.32	St. Ives	.13
Yellow Jacket	.55	Tramps Con.	.04

**N. Y. EXCH. June 28**

Name of Comp.	Cig.	Name of Comp.	Cig.
Amalgamated	62%	Adventure	5%
Am. Agri. Chem.	41%	Allouez	38
Am. Sm. & Ref. com	73%	Am. Zinc	24%
Am. Sm. & Ref. pf.	102%	Arcadian	4%
Anaconda	38%	Arizona Com.	13%
Bethlehem Steel	27%	Atlantic	5%
Col. & Hock. C. & I.	5%	Boston Con.	17
Colo. Fuel & Iron	32%	Butte & Balak	14%
Du Pont P'd'r, pf.	87%	Calumet & Ariz.	52
Federal M. & S.	41	Calumet & Hecla	540
Great Nor., orctf.	56%	Centennial	15
Nat'l Lead, com.	72	Con. Mercur	.08
National Lead, pf.	108	Copper Range	61
Nev. Consol.	19	Daly-West	8
Pittsburg Coal	118%	East Butte	7%
Republic S. com.	31%	Franklin	11
Republic I & S, pf.	93%	Granby	35
Sloss Sheffield, com.	66	Hancock	16
Sloss Sheffield, pf.	117%	Helvetic	2%
Tennessee Copper	23	Indiana	15
Utah Copper	41%	Isle Royale	15%
U. S. Steel, com.	74%	Keweenaw	3%
U. S. Steel, pf.	115	Lake	48%
Va. Car. Chem.	57%	La Salle	11
		Mass	7%
		Michigan	4
		Mohawk	48
		Nevada	18%
		North Butte	23%
		North Lake	10%
		Ojibway	6%
		Old Dominion	33%
		Osceola	128
		Parrot	13
		Quincy	70
		Shannon	9%
		Superior	39%
		Superior & Pitts.	9
		Superior & Pitts.	10%
		Tamarack	50
		Trinity	5%
		U. S. Smg. & Ref.	38%
		U. S. Sm. & Re., pd.	48%
		Utah Apex	3%
		Utah Con.	20
		Victoria	3
		Winnona	6%
		Wolverine	110
		Wyandotte	1%

**N. Y. CURB June 28**

Name of Comp.	Cig.
Bonanza Creek	13
Boston Copper	18
Braden Copper	4%
B. C. Copper	5%
Buffalo Mines	2%
Butte Coalition	17%





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BLUE VITRIOL—(copper sulphate), carload, per 100 lb.

BONE ASH. BORAX, sacks.

CALCIUM—Acetate, gray, 100 lb. Carbide, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J. Chloride, f.o.b. N. Y.

CEMENT—Slag cement. Portland, Am. 500 lb. Foreign. "Rosendale," 300 lb. (in sacks).

CHROME ORE— New Caledonia 50% ex. ship N. Y. Bricks, f.o.b. Pittsburg, per M.

CLAY, CHINA—Am. common ex-dock, N. Y. Foreign.

COBALT—Oxide.

COPPERAS—Bulk. 100 lb. In bbls. In bags.

CRYOLITE (carload). FELDSPAR—Ground.

FIRE BRICK— American. Imported. St. Louis. Extra. Special extra. FIRE CLAY—F.o.b. St. Louis. St. Louis, extra quality per ton.

FLUORSPAR— Domestic f.o.b. Pittsburg: Lump. Ground. Foreign crude ex. dock. FULLER'S EARTH—Lump, 100lb. Powdered.

GRAPHITE—Ceylon. Flying dust, finest to best. Dust. Chip. Lump. Large lump.

GYPSUM— Fertilizer. Ground.

INFUSORIAL EARTH— Ground Am. Best. German.

LEAD—Acetate (sugar of) brown. Nitrate, com'l. MAGNESITE—Greece. Crude (95%). Calcined, powdered. Brick, domes, per qual. f.o.b. Pittsburg.

MAGNESIUM— Chloride, com'l. Sulphate (Epsom salt).

MANGANESE— Foreign, crude, powdered: 70@75% binoxide. 75@85% binoxide. 85@90% binoxide. 90@95% binoxide. Ore, 80%-85%.

MARBLE—Flour.

MINERAL WOOL— Slag, ordinary. Selected. Rock, ordinary.

MONAZITE SAND— Guar. 97%, with 5% Thorium oxide, normal.

NICKEL— Oxide, crude, lb. (77% for fine metal contained). Sulphate, single. Sulphate, double.

NITRATE OF SODA— 100 lb. 95%. 95% for 1910. 96% is 2 1/2 @ 7 1/2 c. higher per 100 lb.

OZOKERITE—best.

PAINTS AND COLORS— Litharge, Am. powdered. English glassmakers. Lithophone. Metallic, brown. Red. Ocher, Am. common.

Best. Dutch, washed. French, washed. Paris green, pure, bulk. Red lead, American. Foreign. Turpentine, spirits bbl., per gal. White lead, Am., dry. American, in oil. Foreign, in oil. Zinc white, Am. extra dry. French, proc's, red seal, dry. French, process, green seal, dry.

PHOSPHATES—Acid. Fla., hard rock 77%. land pebble 68%. Tenn., 78@80%. 75%. 68@72%. So. Car. land rock 60%.

\*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

POTASSIUM— Bicarbonate crystal. Powdered or granulated. Bichromate, Am. Scotch. Bromide. Carbonate (80@85%). Caustic, ordinary. Elect. (90% KOH). Chloride (muriate), 100 lb. Chlorate, powdered. Crystals. Cyanide (98@99%). Carloads (30,000 lb.). 5-ton lots. Less than 5 tons.

Kainite, long ton, bulk, 7.50; bags, Permanganate. Prussiate, yellow. Red. Sulphate (basis 90%), 100 lb.

PYRITE— Domestic, non-arsenical, furnace size, f.o.b. R. R. Domestic, non-arsenical, fines, per unit, f.o.b. mines. Imported, non-arsenical, furnace size, ex-ship, per unit. Imported, arsenical, furnace size, ex-ship, per unit. Imported fines, arsenical, ex-ship, per unit. Imported fines, non-arsenical, ex-ship, per unit. Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore for furnace is delivered in large lumps.

SALT—N. Y. com. fine 280 lb. bbl. N. Y. agricultural. SALT PETER—Crude. Refined, crystals.

SILICA— Ground quartz, ord'ry. Silex, ground. Silex, floated. Lump quartz. Glass sand.

SILVER—Nitrate, crystals. SODIUM—Acetate. "Alkali", per 100 lb. Bicarb. soda, per 100 lb. Soda, caustic, powdered. Salt cake, per 100 lb., bulk. Salt cake, bbl. Soda, monohydrate, per lb. Bichromate. Bromide. Chlorate, com'l. Cyanide, 120-130% KCN, per 100% Carloads (30,000 lb.). 5-ton lots. Less than 5 tons. Hyposulphite, Am. Phosphate. Prussiate. Sal soda, f.o.b. N. Y. Foreign, f.o.b. N. Y. Silicate, com'l. Sulphate, com'l. (Glauber's salt).

Sulphate, com'l, calcined. STRONTIUM—Nitrate. SULPHUR—Louisiana (prime) to New York. To Boston, Philadelphia or Baltimore. Roll. Flour. Flowers, sublimed. Powdered commercial, bags. Sicilian, extra qual., unmixed seconds, crude brimstone to New York.

TERRA ALBA—Fr.&Eng. TALC—Domestic. French. Italian, best.

TIN—Bi-chloride, 50°. Crystals. Oxide, lb.

URANIUM—Oxide. ZINC—Chloride sol., com. 20°. Chloride, granular. Dust. Sulphate.

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their output as a matter of private contract.