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The Cost of Mining—General Conditions

Discussion of Factors Controlling Variations. Low Costs in Mining May Mean Greater Expenses Elsewhere. Losses of Ore Often Neglected

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The following is the first chapter of a general discussion of the cost of mining in the leading districts of the United States and some districts in the outside world. I have had the benefit of criticism and suggestion from several leading mining men, among whom I may mention F. W. Bradley, Dr. James Douglass, J. Parke Channing, Prof. H. L. Smyth, T. A. Rickard, W. R. Ingalls, Cortlandt E. Palmer and C. P. Perin. Naturally, I could not embody all the suggestions made without exchanging my own opinions for those of others. The subject is a live one and in coming down to details in it all cannot agree. Nevertheless I have adopted wherever possible the suggestions offered and many have been valuable.

The plan of the articles is to discuss first the factors that determine variations in cost and then in the following papers show how these factors work out in the production of coal, iron, lead, zinc, copper and gold. The order in which these articles may appear is not yet fully decided. The first paper is a discussion of the factors controlling costs.

It is necessary first to define what we mean by the cost of mining. It may be divided into three parts:

(A.) The use of capital in acquiring the opportunity to mine, i. e. ownership of ground, or leases. Since the value of this kind of property is only a speculative anticipation of profits to be won by operating, and is moreover often appraised in a fanciful or even dishonest way, I prefer to leave this element out of the discussion. I am quite aware, however, that as a matter of practical finance this cost must generally be considered.

(B.) The use of capital for equipping and developing a mine, for providing mills and smelters.

(C.) Current operating costs, including taxes, the maintenance of company organization, insurance, litigation, etc.

For present purposes I select B and C and my definition is: The complete cost of developing, equipping and working out a mine, allowing interest on the capital required for these purposes until it is returned in dividends.

As anyone with the most meager acquaintance with the subject must know, the cost of mining at different places is subject to great variations. I am not sure that the factors governing these variations have ever been fully stated.

A general division may be made between factors that are external or fortuitous and those introduced by the internal makeup of the orebodies. It is evident that no quality in the deposit itself can influence any of the following groups of conditions:

(1). The cost and quality of labor and supplies.

(2). The climate, altitude or distance from populous centers.

(3). The hardness of surrounding rocks, the amount of water, the depth from surface.

(4). The facilities and cost of transportation to milling or smelting centers or markets.

All of the above conditions vary from place to place and introduce differences in the cost of mining, though not such great differences (as will be shown later) as are caused by the inherent qualities of the orebodies themselves.

COST OF LABOR AND SUPPLIES

The wages in the mines of the United States vary between 20 and 50c. an hour. Usually the difference is partly made up by the varying efficiency of the men. Where wages are low the supply of labor is meager, the best men are constantly leaving for more favorable localities, those employed are not subject to the spur of a keen competition, and the results are constantly disappointing. On the other hand where wages are high, the most ambitious and intelligent men are attracted and they compete with each other for the place.

It is hard to fix any figure for the compensation thus effected, but it would perhaps be safe to say that one-half of the apparent difference is made up. Some authorities will say it is nearly all made up. Messrs. Taylor & Brunton tell me that in operating sampling mills at Cripple Creek, Colo., where the wages are 40c. an hour, and at Salt Lake City, where the wages are 25c. an hour, there is but little difference in the labor cost per ton

sampled. If we assume that while the difference in wages is represented by 20 and 50 and the difference in cost efficiency by 35 and 50 (or 70 and 100), we find that the variation in labor cost is only about 30 per cent. from the maximum. Since the labor accounts generally are about 60 per cent. of the total current cost of mining, differences in wages are not likely to account for a variation of more than 18 per cent.

In the world at large, outside of the United States, there may be instances where the differences in wages are more important than within the United States. Nevertheless, in the few important mining districts of which I have any knowledge, such as the Transvaal, India and Mexico, where native labor is employed very largely at very low rates, it is well known that the costs are not lower than in the United States for similar work. It appears that where labor is very low there is little or no acquaintance with machinery and the performance per man is correspondingly low. Where large numbers of natives, ignorant of all civilized mechanical appliances, are employed at a large plant, they must be supervised by white men who do little actual work and get wages higher than those they receive at home.

In the important English-speaking countries where mining is an important industry, it may be said that the conditions as regards labor are almost identical with those of the United States. It does not appear probable, therefore, that my conclusions regarding the variations caused by wages in the United States need to be essentially changed when applied to the important producing centers of the world at large. Extreme variations must be confined largely to isolated and abnormal localities.

The cost of supplies directly affects the cost of running. The important supplies are fuel, timber, explosives, steel and tools. In the United States the price of these commodities does not vary enormously among the important mining centers, certainly not much more than 50 per cent. from the maximum. Since the collective cost of the various supplies is rarely more than 20 per cent. of the total current mining cost, a variation of 50 per cent. in the

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price will produce a difference of only 10 per cent. in that cost.

The cost of supplies in the world at large is apparently subject to about the same degree of difference as the cost of labor, but it is to be remarked that in any country, such as India and South Africa, where the price of labor is nominally low, the cost of supplies is usually distinctly higher than in the United States. In the Transvaal for instance Ross E. Browne estimates that the additional cost of supplies as compared with California accounts for approximately 10 per cent. of the total cost of mining.

UNDERGROUND CONDITIONS

The hardness of the rock is likewise a comparatively unimportant factor. In any case the hardness affects only one division of the underground work; namely, breaking the ground. The stability of the ground is much more important than the hardness. Timbering is often an important item.

Increase in depth adds a certain increment to the cost of hoisting and pumping, but it is to be remembered in this connection that if a mine is only 100 ft. deep, machinery must be provided for these purposes and a complement of men employed to operate it. As depth increases, the only change that comes in is the requirement of heavier machinery and additional power. The increase of cost, therefore, is far from being proportional to the depth. One consequence of extreme depth that might easily be overlooked is the daily cost of transporting the men to and from their working places. In the case of the Calumet & Hecla, the hoisting engines are in use two hours each shift in lowering the men and hoisting them out again. Not only does this represent a considerable expense in itself for mere hoisting, but far the greater part of the time of the workmen for this period is lost to the company.

The temperature of underground workings often becomes a matter of considerable importance. A high temperature may be caused by the climate, or by great depth, or by the presence of hot waters or heat-producing chemicals. It is only in the last case that the heat can be called an inherent quality of the orebody itself. There have been cases of such high temperatures in mines as almost to prevent working altogether, but ordinarily temperatures of 80 or 90 deg. F. are about the limit reached in important mines. Such temperatures affect the energies of the men adversely, although men grow accustomed to them and suffer no ill consequences in the way of health. The importance of this factor is extremely difficult to appraise in figures, although in the case of the Calumet & Hecla, Anaconda and United Verde, to cite conspicuous examples, the loss of effective-

ness in labor through this cause must represent annually a very large sum.

These remarks are intended to apply only to underground mines. Where the work is done wholly upon the surface, the facilities for working are so much superior that mines of this character must be considered separately.

CLIMATE, ALTITUDE, AND POPULATION

The influence of climate, though indirect, is powerful through its effect on human life and effort. Sometimes in places where there is an excessive rain fall or excessive heat or unhealthy conditions, the effect may be to limit the scope of operations. For instance in Ecuador, South America, a plant has been running 25 years, but on account of the climatic influences it has never been possible to secure more than about 60 effective miners, although the economical management of the property requires the employment of several times as many.

Excessive altitude, and great distance from lines of transportation place similar limitations upon enterprise. Where several factors of this kind are present at the same locality, the aggregate effect is to place almost unsurmountable difficulties in the way of successful operations, but as a general rule in places where important mines have been discovered, most of these difficulties have been overcome. For instance, in the San Juan region of Colorado, and in the Cerro de Pasco in Peru, adequate transportation facilities have been provided and the only adverse conditions still remaining are the altitude and disagreeable climate which have in both instances a pronounced ill effect upon the performance of the labor.

TRANSPORTATION AND MARKETING THE PRODUCT

Transportation facilities may be described as adequate when they are sufficient to handle the output of a mine and to deliver with promptness the necessary supplies, but adequacy in this sense does not mean cheapness. Transportation is in very many cases one of the most vital elements in the cost of mining. This is particularly the case when the products have to be shipped considerable distances. In the case of coal and iron it is a matter of common knowledge that transportation is often the all important factor, and even in the case of precious metals sometimes the cost of transportation to mills and smelters equals, if it does not exceed, the cost of actual mining. The intimate bearing of this fact upon mining methods and results aside from the mere question of transportation costs in themselves will be described later on.

Another factor that is often of considerable importance is the commercial matter of marketing the products. This is sometimes done by contract with selling agencies; and sometimes by the com-

pany itself. In either case there is to be taken into consideration in addition to the cost of marketing, the success achieved in disposing of satisfactory quantities of the product. It is in this respect particularly that the cost of mining may be greatly influenced through the effect produced by this factor in determining the volume of operations.

One would scarcely expect that all these various factors would move in unison, i.e., that they should all be equally bad in one place and equally good in another. So far as the natural conditions such as rock hardness, depth and amount of water to be pumped are concerned, it is indeed extremely unusual that such factors are at a given place at either extreme; but it must not be forgotten that the remaining external factors have their effect through the efforts of man himself. If the mine is situated far from populous centers the reason is apt to be that the climate or the altitude is unfavorable. This generally means that labor is dear and inefficient, supplies costly, transportation difficult and expensive. These factors are likely therefore to be affected together and if one is favorable they are all likely to be favorable and *vice versa*.

The sum total of cost variations that may be due to the coincidence of these external factors is therefore considerable and is sufficient to prevent the working of abundant yet valuable products such as coal, iron ore or salt at places where these conditions are all bad. It may be said that the above factors are those which as a rule govern the variations in the cost of low-priced and bulky mineral products.

INTERNAL FACTORS

The internal factors are: (1) The size and attitude of the orebodies; (2) the relation the valuable material bears to the inclosing gangue or material; (3) the problems involved in metallurgical treatment.

These factors introduce immense differences of cost. For instance, in gold mining we find that the Alaska-Treadwell has mined, treated, and marketed its ore for \$1.28 per ton, while the Camp Bird in Colorado producing gold ore subjected to the same process costs \$12.50 per ton. The wages are the same, the rock is of the same hardness, the water is no problem in either case, the method of mining even is practically the same. The general management of the Treadwell is probably more economical than that of the Camp Bird, but the difference is not to be laid to this score. The difference comes in the factors mentioned above and those factors are so important that they are worth a more extended consideration.

If we have a body of homogeneous material more than four feet thick and continuous it is evident that the mine openings can be made very largely, if not wholly, in the stuff to be extracted.

Practically every blow struck produces ore. But reduce the thickness to be mined to one foot and we are at once confronted with the necessity of taking out three feet of worthless material for one foot that is valuable besides having to take pains to keep them separate. Here we introduce at once an enormous proportion of wasted expense that must be borne by the valuable ore. Now break the continuity of the deposit and it is evident that openings have to be made entirely through waste material merely to find and open up the scattered bodies. This evidently increases the cost still more. Now, since it costs about as much to handle one kind of rock as another, it is very evident that the cost of handling narrow and non-continuous orebodies may be many times greater than the cost of mining orebodies large enough to afford room to work in. A sort of dead line is established by a thickness of approximately four feet. Orebodies thicker than four feet are only moderately cheaper to handle than those of about that thickness.

The attitude of an orebody has a great deal to do with the cost of extracting it. For instance, in the anthracite coalfields, in Pennsylvania, and in various other coalfields the beds are thrown into a succession of folds with constantly varying slopes. The effect of this is double. First it renders more difficult the taking of the material from the working places to the haulage roads and secondly it renders necessary a large amount of dead work in order to reach the various parts of the beds and also prevents regular systematic working. These two factors are sufficient to introduce a great increase of cost over that of mining a flat and unbroken seam.

Faulting of the beds or veins and the occurrence of barren patches, introduce complications similar to those caused by folding, but very much more variable in their nature. The folding of the formation is invariably regional and is felt rather uniformly by all of the mines in a given district, while a series of faults may affect only one mine in a group in spite of the fact that that mine may have just as good ore and as much of it as its neighbors.

HOMOGENEITY OF ORE

The homogeneity of the ore is a factor of great importance. This quality determines whether it is necessary to subject to metallurgical treatment the whole or only a part of an orebody. If only a part need be so treated we have a concentrating ore. The manner in which the valuable mineral lies in the inclosing rock determines how the concentrating must be done. In any case the process of concentration involves loss and expense and the question of how far this loss and expense is justified depends on the

cost and character of the subsequent metallurgical treatment.

The cost of the metallurgical treatment depends primarily on the proportion of ore that must be treated. This proportion varies at different mines from 2 to 100 per cent. Obviously where only 2 per cent. must be treated the cost of treatment as applied to the whole orebody will be less than where all is treated. The inherent metallurgical problem is therefore only reached when the question of selection is settled.

LOW COSTS IN MINING MAY MEAN GREATER EXPENSE ELSEWHERE

The above seems a sufficient explanation of the fact that it is necessary to a discussion of mining to include a consideration of the processes by which the ore is to be treated. It is not possible to run a mine intelligently without achieving whatever economy there may be in dressing the ore so that the further handling will be facilitated. Efforts to make "records" of low costs per ton have in many cases actually resulted in good mines being run at a loss. In this connection I can do no better than repeat some remarks from an article published in the ENGINEERING AND MINING JOURNAL some years ago on "Mining Costs at Cripple Creek:"

"Let us take as a practical example a body of 10,000 tons of ore, running 1 oz. gold per ton. This ore can be shipped without sorting at a handsome profit, as follows:

Gross value of ore.....	\$200,000
Cost of mining 10,000 tons at \$3 per ton....	\$ 30,000
Freight and treatment, \$8.25.....	82,500
Total cost.....	\$112,500
Profit.....	\$ 87,500

"But suppose we reject half of this ore by sorting. By so doing we throw away 5000 tons that will average \$2.50 per ton, or \$12,500. The cost of sorting, at 50c. per ton, will be \$2,500 more. Then our shipment will be as follows:

5,000 tons, at \$37.50 per ton.....	\$187,500
Cost of mining and sorting, \$6.50 per ton....	\$ 32,500
Freight and treatment, \$11.25.....	56,250
Total cost.....	\$ 88,750
Profit.....	\$ 98,750

"In other words, the gross receipts in this case have fallen \$12,500. The cost of mining per ton is more than twice as great; the cost for freight and treatment per ton is \$3 greater. The apparent showing by the superintendent is very bad; but nevertheless he has made for the company \$11,250 clear profit on the transaction.

"In the first case our total cost for mining, freight and treatment is only \$11.25 per ton; in the second case it is \$17.75 per ton, but there is more money in the higher cost. This is an example that has been worked out in practice."

A false economy often results also from

mining too much in a mere attempt to produce a greater output than the development of the mine really warrants. This invariably results in mining waste at a dead loss, but as this loss is on the same basis as the above, there seems no need to follow the discussion further.

EFFECT OF LOSSES IN DETERMINING COSTS

Mining, milling and smelting losses often foot up to a total that is simply alarming. Now since it is almost self-evident that crude methods involving high losses may be cheap as regards operating costs, there is always likely to be a question whether there is any economy in low costs obtained at the expense of undue waste, or whether, on the other hand, high efficiency of methods may not be at the expense of excessive cost. I think it has seldom been considered that there are such substantial losses in each department of the business. If we hear a discussion of mill losses in a given district it is to be noticed that the question of mine losses is apt to be ignored; if attention is called to mine losses there is apt to be silence on the subject of smelting losses. It seems desirable therefore to draw attention to some of the salient facts in regard to losses.

There never was a mine from which all the available ore was extracted. The ore is exposed to wastage from a variety of causes. If the orebody is large, soft and homogeneous, as in the Lake Superior iron mines, ore is lost through absolute failure to mine it. Some is forgotten until the openings to it are caved and lost. Some ore is constantly being mixed with sand or rock and left because its grade has been lowered. Some is surrounded by the caving of the overburden into the mine openings in such a manner as to be irrecoverable. System, care and expense will do much to diminish these losses. It may happen that beyond a certain point the cost of perfecting the extraction may increase very rapidly, may indeed necessitate a different and more costly method of mining.

Since mines are worked for the profit and not for the gross value of their output it may be more economical to choose a cheap method in which the waste of ore may be great. For instance, suppose an ore worth \$2 a ton can be mined with a 90 per cent. extraction for \$1.25 a ton, but that by another method at a 75 per cent. extraction, it can be mined for 90c. a ton. One hundred tons of ore in the ground would in the two cases yield the following results:

ORE WORTH \$2 PER TON.			
	Tons.	Cost.	Value. Profit.
First case..	90	\$112.50	\$180.00 \$67.50
Second case	75	67.50	150.00 82.50 = \$15 gain.
ORE WORTH \$5 PER TON.			
First case..	90	112.50	450.00 337.50
Second case	75	67.50	375.00 307.50 = \$30 loss.

It is evident therefore that even in the most homogeneous materials the cost of

mining is directly affected by the value of the product.

SMYTH'S FORMULA

Prof. H. L. Smyth works out the mathematical expression for the proportion of the deposit that may be abandoned in order to secure a lower mining cost per ton as follows:

Let Q equal the total number of tons of ore in a deposit recoverable by a most favorable method; X , the number of tons abandoned by any other method; p , the profit per ton by method Q ; and p' , the profit by the method other $Q-X$. When $(Q-X)p'$ equals Qp , the two methods are equally desirable. Therefore,

$$\frac{p}{p'} = \frac{Q-X}{Q}$$

and

$$\frac{X}{Q} = 1 \left(\frac{1-p}{p'} \right) = \frac{p'-p}{p'}$$

Then $p' - p$ equals the saving per ton effected by the second method. The proportion of the deposit that may be sacrificed therefore depends on the ratio of the saving to the profit per ton. This ratio increases as the profit diminishes; therefore for a given saving a larger proportion of ore of low value may be sacrificed than of high value.

OTHER CAUSES OF LOSS

In flat deposits, in hard rock it is nearly always necessary to leave some ore in pillars. Where the deposits are steeply inclined some ore is usually left in pillars unless the body is exceedingly small. In the case of very large bodies of low-grade ore, like the Alaska-Treadwell, large amounts are left in this manner, not only to insure the safety of the mine but also to insure cheapness of working. In every case where pillars are left there is a likelihood of portions being ultimately lost.

Where ores are sorted, i. e., where they are not homogeneous, some good material is always rejected through ignorance or carelessness. Where filling is introduced into a stope there is invariably a certain amount of good ore that falls in with it and is lost. Where low-grade ores are sorted out and stowed underground because they cannot be shipped and treated except at a loss, there is a great loss of metallic value, but since it cannot be said that such material is payable it cannot under present conditions be called a loss.

These mining losses are, I believe, seldom measured. More or less accurate guesses are made by the engineers on the ground, but the losses in mining are almost never seriously reported. In a general way we may place mining losses at from 5 to 30 per cent. of the developed ore.

LOSSES IN MILLING AND SMELTING

Milling losses are in some localities painfully and accurately studied; in other places they are casually guessed at or ignored. It is usually fashionable to guess the extraction at 80 to 90 per cent. for concentrating and at about 95 per cent. for cyaniding or chlorinating. Sometimes, as a matter of fact, losses in concentration amount to 40 per cent. or even more. When the milling is not systematically and accurately checked the losses as a rule are much higher than the owners imagine. Little definite information is to be had.

Smelting losses are probably determined much more accurately than either mining or milling losses, but they are almost never mentioned in reports to stockholders. In this department of the business it is necessary to take more or less general statements of metallurgists.

to a ready adjustment, we find that refinements of methods designed to limit losses are fixed to those that will be economical at rather low prices. For instance we find copper plants are planned to make savings that will be economical at 13-c. copper instead of at 25-c. copper; lead plants are planned for 4-c. lead and not for 6-c. lead, etc.

WASTE IN EXPLOITATION

At this point it may be pertinent to remark that questions of mere economy and profit may come into conflict with public policy. Much has been said about the necessity of conserving the forests of the United States. A forest when denuded is not beyond the possibility of ultimate replacement; an orebody or a coal seam, on the other hand, once destroyed is gone forever. It is very likely out of the sphere of the Government to

PROPORTIONATE RECOVERY AND LOSSES IN 100 TONS OF ORE IN SOME IMPORTANT MINING DISTRICTS.

	Pittsburg Coal.	Lake Superior Iron.	S. E. Missouri Lead.	S. W. Missouri Zinc.	Lake Superior Copper.	Cripple Creek Gold.
Gross value in the ground.....	\$110	\$800	\$460	\$500	\$280	\$1000
Gross value recovered by mining.....	88	\$600 to 760	400	\$375 to 475	246	\$850 to \$950
Gross value recovered by milling.....			\$300 to 340	187 to 300	186	782 to 912
Gross value recovered by smelting....		550 to 744	270 to 332	163 to 260	180	840 to 940
Gross aggregate losses.....	\$ 22	\$ 56 to \$250	\$128 to \$190	\$240 to \$337	\$100	\$ 60 to \$160
Per cent. recovered.....	80	70 to 93	58 to 72	33 to 52	64	78 to 94

The aggregate losses represent the maximum of additional operating expense theoretically justifiable by the extinguishment of losses.

The importance and economic bearing of the losses sustained in some representative districts are shown in an accompanying table. Much care must be exercised in the interpretation of these figures for economic purposes. The values thrown away are theoretical values. The practical limit of extraction invariably falls short of 100 per cent. The real purpose of the table is to show in current practice the debatable ground in which the curtailment of losses is confronted by a rising scale of costs.

It has been shown in the case of Cripple Creek ores how a mining cost may be too low and it may be shown in the same way that milling and smelting costs may be too low. As a matter of fact they are very apt to be too low; rather more often too low than too high. Nevertheless it is perhaps well to point out that the economical cost is always a function of the value of the product. Of the various products of mines gold is the only one whose value is fixed. Where the product is variable in price the proportion of the losses is constantly changing, and the amount of expense warranted by the pursuit of such losses also varies. Since the operation of a mine, mill or smelter is usually a thing that does not lend itself

interfere in the disposition of properties that have passed to private ownership, but it is quite feasible for the Government to take measures to prevent undue waste in the exploitation of the lands that it still retains; and it seems fully worth while for large private proprietors to consider the future as well as the present and to take measures to prevent some of the shameful wastes that are going on.

For instance, no one will deny that ultimately the world will need every ton of coal that can be had. Future generations will be very glad to mine coal from 2-ft. seams, many of which are now utterly destroyed by the working out of thicker seams not far below them. Similarly, it would seem worth while for land owners to bring pressure to bear in the working of metal deposits like those of southwestern Missouri where there is a waste of at least 50 per cent. of the zinc, and at Lake Superior where there is an enormous waste of low-grade iron ores which have been caved in and left behind during the extraction of richer portions. Wherever the introduction of these economies in material can be affected without financial loss, their introduction can do the operators no harm

and will certainly be a benefit to the land owners and to the public at large.

STATEMENT OF MINING COSTS

A true statement of mining costs, therefore, should with due consideration of the above factors fall under the following headings:

(1) General expense of the company.....	1
Exploration and development.....	2
Stopping cost.....	3
(2) Mining.....	
Stopping and sorting losses.....	4
Amortization of mining plant.....	5
Transportation to mill.....	6
Operating costs.....	7
(3) Milling.....	
Losses.....	8
Amortization of milling plant.....	9
(4) Smelting, refining and marketing.....	
Transportation to smelter.....	10
Operating costs.....	11
Losses.....	12
Amortization of smelting plant.....	13

Unfortunately it is impossible to treat the subject so comprehensively owing to the absence of adequate reports. Most companies are ignorant of both their costs and their losses; some know their costs but do not know their losses; very few know both. Some of the most scientifically managed concerns, like the American Smelters Securities Company, issue very few reports, although the management of this company does publish one report, that of the Esperanza Limited, which tells the whole story, but even in that model statement there is no specific reference to the amortization costs nor to mining and smelting losses. Amortization is partly cared for under the head of "Renewals Reserve." Stopping and sorting losses are not stated, but are probably small.

Where a company does not own a mill or smelter it cannot, of course, state details for any amortization charges or operating costs or losses for those departments. Nevertheless, these things cannot be ignored either scientifically or commercially. Charges for them are fixed by contract. When a mine sells its ore to a smelter it pays commercially for amortization and operation of the smelter under treatment charges and for the losses by arbitrary deductions.

In the absence of such reports as will give the essentials the most feasible plan of treating the subject seems to be to divide the costs into three main headings: (1) Mining, including development; (2) milling, including transportation from mine; (3) smelting, refining and marketing, including transportation from mill and to markets.

Generally the reports, or reliable information, are sufficient to give a fairly close approximation to the costs. It is seldom indeed that any statement can be found showing the charge to be made under each of these headings for amortization of plants, but there is usually some means of getting an idea of it. This can be done many times by simply ignoring credits to capital on construction accounts over a considerable period of

years. This can be done on the logical principle that since the construction is all for the benefit of the operation of the mine it should all be absorbed in operating accounts. It will hardly be advisable to give in all cases the sources of information on which the cost estimates are based; but it is possibly worth while to assert that the figures are not far from the truth in spite of certain differences from published statements.

MANAGEMENT

In discussing the factors that determine the cost of mining I have touched thus far only upon the tangible and definite ones of whose importance we can get a more or less logical measure; but the discussion would not be complete without some mention of the intangible and unmeasured but important factor of management. I wish to apply the term in its broadest sense and include in it the financing of an enterprise, the determination of its scope, the selection of its methods and its administration.

To begin with, it is noticeable that enterprises in a given district have much in common and are apt to differ in methods from the enterprises of other districts. For instance, in Cripple Creek it is rare for a mining company to treat its own ores, while in Butte most companies have done so; in the Lake Superior copper mines the underground work is done largely by contract with the miners, while in Arizona this is exceedingly rare, and so on. Each district has its own peculiar methods.

There is a probability that the methods of a given district are pretty nearly correct because they are inevitably the result of experiment, or evolution, and the fit have survived. It is logical to expect this. When a man comes into a district that is new to him and says that the industrial methods in use there are wrong, he does nothing less than declare that the thousands of people who have developed those methods are either ignorant or stupid or lacking in enterprise. Once in a thousand times he may be right; in 999 cases he doesn't know what he is talking about.

To illustrate how profoundly true this principle is even in the face of reasons to the contrary, I may be pardoned for relating an experience of my own: While traveling on the slopes of the Andes in Ecuador 10 years ago I noticed that my traveling companion, a Spanish-American, did not wash or bathe but carried in his vest pocket a small bottle of camphor with which he occasionally rubbed his nose. Whenever we came to a stream I would very likely take a bath. To this Rodriguez objected vigorously, saying, "If you want to live in this country without getting the fever you must observe two rules, namely, sleep in a closed room, and don't bathe out of doors." I told him, and thought

that the true laws of health demanded fresh air and cleanliness, and probably every Anglo-Saxon would have said the same thing. But, on returning to this country a few months later, I heard of the mosquito theory of malaria and saw a new light. Rodriguez was right. Observation had taught the natives empirically two ways of keeping off mosquitos and fairly effective ways. They could not give the reasons but they got results. It is quite true that a mosquito net is just as good as a coat of dirt to ward off the fever-bearing insect, and that by means of it one may also enjoy the luxury of fresh air; but the point is the *mosquito must be kept out*. The person who does not realize this is running a risk of death from sheer ignorance. The same thing may be said of superficial criticism of customs in general and of mining customs in particular. There is very apt to be a "joker" in the game for the rash innovator and he may find himself with his new methods up against a hand of five aces.

I feel therefore that, as a general rule, it is unfair and stupid to measure the methods of one district by the standards of another, but this does not mean that the methods in use are always the best. Among operators in the same district, where all are equally conversant with the governing factors of the situation, we will invariably find some who get better results than others. We will find, running side by side, mines that show great and apparently inexplicable differences in cost. We will find in any district examples of mines that have failed under one management and succeeded under another. While the effect of management is well understood by everyone, it does not lend itself to expression in figures; nevertheless there are some things that may be said of it of a nature pertinent to this discussion.

One thing has been noted as a rule; viz., rich mines cost more to run than low-grade mines. It is generally conceded that this is to be explained by the liberality of the carefree. There is something more than this. Suppose two deposits are found 20 miles apart, one of ore worth \$5 a ton and the second worth \$2 a ton. The first is opened up by the first method that occurs to the owners, the ore is shipped and it is discovered that it costs \$3 a ton to mine. The owners congratulate themselves on their 40 per cent. profits. Their business is established; they are making lots of money; to make changes and improvements is laborious, expensive, may involve delay in marketing the product and may not turn out well after all. Why not leave well enough alone?

The second body of only \$2 ore, after being opened up, is left alone for a while. It is considered two low-grade to pay. But some enterprising person at last comes

along who thinks it may be worked. He chooses for a superintendent, not the first man he meets, last of all some friend or relative, but someone he thinks able to get results. All possible methods are studied in order to choose the cheapest. All possible precautions are used to avoid unnecessary expenditures on plant. Every employee is impressed with the necessity of getting results. After the enterprise is finally going it proves that the ore is being mined at \$1.20 per ton and the triumphant owner of the \$2 ore also achieves 40 per cent. profit on his product.

LOGICAL REASON FOR RICH MINES COSTING MORE

There may be no physical reason for this difference in cost; there may be no intentional liberality on the part of the owners of the richer property. Nevertheless, there is a logical ground for a difference in the selection imposed by necessity. In the rich mine there is no necessary selection; *ergo* there is no selection. We may, therefore, count on a certain increment, sometimes very large, sometimes very small, of additional expense in mining rich ores as compared with poorer ores.

Necessity may work vast economies in the same mine. The Champion iron mine at Beacon, Mich. was producing ore in 1892 at \$2.50 a ton. It had then been running 25 years and was reputed to be a very well managed mine. In 1899, the mine was deeper, the orebodies smaller, wages the same, the plant the same, the management the same, but the ore only cost \$1.25 per ton. Necessity had worked this change through the panic of 1893. Similar changes were wrought in other mines.

HOOVER'S THEOREM

The economic ratio of treatment capacity of ore reserves is a question that has been brought up by H. C. Hoover and vigorously discussed by many prominent engineers. Ross E. Browne ("Working costs on the Witwatersrand") has recently brought additional evidence to bear out the correctness of Mr. Hoover's conclusions that economical mines should be worked out with great rapidity and that additional plant should be provided for the extraction of discovered ores within periods of from three to six years. There seems to be no doubt of the mathematical correctness of this conclusion, but it seems to apply logically only to gold mines where there is no practical limit to the sale of the output. In the mining of products other than gold it seems that a limitation is put upon the output by the market. In the case of Lake Superior iron ores, for example, there are fifteen hundred million tons in sight. To work these all out and convert them into pig iron in six years is not only a physical impossibility, but would be economically

absurd. It is not at all absurd, however, for an isolated operator among many to apply this principle to his own profit. It may be that the application of this very principle has resulted in the formation of gigantic trusts. It seems probable that the growth of the Carnegie Steel Company in competition with its neighbors may have been largely due to the application of this idea to steel manufacturing; but in course of being fully worked out, the result was the formation of the United States Steel Corporation which now controls 60 per cent. of the iron ores of Lake Superior and from mere extent of growth has landed in a position where the application of Mr. Hoover's principle is no longer possible.

ECONOMY AND SPEED

It is to be remarked in this connection that a wideawake manager may see his way clear to overlook questions both of a high percentage of extraction and of cheap work to reap the benefits incident to speed. Take for example a body of soft iron ore of limited cross section pitching rather steeply into the earth. The requirements of thorough extraction and cheap working would very likely be satisfied by the use of the slicing system of mining, but in such a case the volume of product would be limited because the area on which slicing can be conducted is practically limited to a single horizontal section of the orebody. This limitation of the product during years of high prices might be a very serious handicap and it would probably be wise to adopt a different system, perhaps less effective and more costly, but which would allow the working of a number of levels at once, and the turning out of a large output at an advantageous time.

The management of large properties may come into conflict with public economy in the following way: Large sums of money are locked up in the purchase of great tracts of mineral lands, far in excess of the requirements of the immediate future. The sums thus invested are usually raised by bond issues and the interest on these, together with taxes amount annually to large sums which the public must pay. These charges are inevitable, and are quite independent of any desire on the part of such holders to raise prices through the opportunities afforded by the existence of partial monopolies. Conspicuous examples of this state of affairs are afforded by the United States Steel Corporation, especially since it has absorbed the Tennessee Coal, Iron and Railroad Company and by the Philadelphia & Reading Coal and Iron Company. Both these great corporations have mineral lands sufficient to guarantee their product far into the future but they represent investments on which charges of many million dollars a year must be paid, and paid by the public.

Steel Production in 1907

The American Iron and Steel Association has completed the collection of statistics of open-hearth steel production in the United States for 1907. The figures show 10,803,211 long tons of ingots and 745,877 tons of direct castings; a total of 11,549,088 tons, being an increase over the preceding year of 568,675 tons, or 5.1 per cent. The division of this steel by the process used was as follows:

	1906.		1907.	
	Tons.	Per Ct.	Tons.	Per Ct.
Acid.....	1,321,653	12.0	1,269,773	11.0
Basic.....	9,658,760	88.0	10,279,315	89.0
Total.....	10,980,413	100.0	11,549,088	100.0

There was a decrease of 51,880 tons in acid steel, but an increase of 620,555 tons in basic steel. The production by States in 1907 was as follows:

	Acid.		Basic.		Total.	Per Ct.
	Tons.	Per Ct.	Tons.	Per Ct.		
New England.	66,837	772,960	239,797	2.1		
N. Y. and N. J.	40,545	665,474	706,019	6.1		
Pennsylvania.	1,041,226	6,826,479	7,867,705	68.1		
Illinois.....	6,662	1,006,589	1,013,251	8.8		
Ohio.....	61,241	758,401	819,642	7.1		
Other States..	53,262	849,412	902,674	7.8		
Total.....	1,269,773	10,279,315	11,549,088	100.0		

Pennsylvania made 82 per cent. of the acid steel, and 66.4 per cent. of the basic. The acid-steel production in other States was small.

We have now the total production of steel in 1907, with the exception of the comparatively small output of crucible and special steels, which can be closely estimated. This gives the total production of steel in the United States for two years past as follows, in long tons:

	1906.		1907.	
	Tons.	Per Ct.	Tons.	Per Ct.
Bessemer.....	12,275,830	52.5	11,667,549	50.0
Open-hearth.....	10,980,413	46.9	11,549,088	49.4
Crucible, etc.....	141,893	0.6	143,000	0.6
Total.....	23,398,136	100.0	23,359,637	100.0

The loss of 608,281 tons in bessemer steel was not quite offset by the gain of 568,675 tons in open-hearth, so that we find in the total the small decrease of 38,499 tons, or 0.16 per cent. Last year came very near fulfilling the prediction made three years ago that the open-hearth steel output would soon equal that of bessemer or converter steel.

The total production of steel for 10 years past has been as follows, in long tons:

1898.....	8,932,857	1903.....	14,534,978
1899.....	10,639,857	1904.....	13,859,887
1900.....	10,188,329	1905.....	20,023,947
1901.....	13,473,595	1906.....	23,398,136
1902.....	14,947,250	1907.....	23,359,637

The total of 1907, though a little below that of the preceding year, was 2.6 times that of 1898, and 61 per cent. in excess of the production of 1903. It exceeded that of Germany and Great Britain together.

Guanajuato is one of the first districts in Mexico at which mining was undertaken by the Spaniards after the conquest by Cortez in 1521. Even before the arrival of the Spaniards the Aztecs mined silver at Guanajuato. Guanajuato is still one of the largest silver-producing camps in the world.

The Mica Industry in Canada

By FRITZ CIRKEL*

Mica mining in Canada has received quite a set-back from the recent financial trouble in the United States. One large electrical concern from Pittsburg, which has a mica-cutting establishment at Ottawa, has discharged almost its entire

Sydenham, Ont., and also from properties near Perth, the Hanlan, the Martha and the Richardson mine; but most of these mines have been shut down on account of the present depression.

At present not more than 220 persons, mostly mica cleaners and splitters, are engaged in the industry, whereas in a busy season about 1700 are employed, but it is predicted next spring orders will come in as usual, principally from the United

States, and also from properties near Perth, the Hanlan, the Martha and the Richardson mine; but most of these mines have been shut down on account of the present depression. At present not more than 220 persons, mostly mica cleaners and splitters, are engaged in the industry, whereas in a busy season about 1700 are employed, but it is predicted next spring orders will come in as usual, principally from the United States, and also from properties near Perth, the Hanlan, the Martha and the Richardson mine; but most of these mines have been shut down on account of the present depression.

ured plate mica. This mica is built up of the thin split material, pressed in powerful hydraulic presses. As a rule the Canadian mica factories receive the mica from the mines in a rough thumb-trimmed condition; at the mica shops this mica is first culled, cleaned, then graded, knife-trimmed, thin split, and finally worked into plates. For the production of say 1000 lb. of thin split and mica plate, the following force is required: 300 girls for cleaning, grading, and thin splitting; 200 girls for the plate building department; 50 girls for hand and machine knife trimming; 20 men; total 570 persons.

In addition, from 35 to 40 machine knives, and two powerful hydraulic presses for the manufacture of plates are required. It is claimed that the manufactured mica plates are stronger than the natural mica sheets from crystals; it is urged that the lines of molecular weakness, which are the cause of the pressure and percussion figures in the natural sheets, are eliminated through the flexibility of the single mica films, and for this reason the strength is increased. Unless this is proven through a series of experiments under equal conditions, this statement cannot be accepted, because the natural mica sheets, if properly selected, show distinctly fine and perfect lamination without any foreign substance, and it is hardly possible that this can be made artificially. There is no mineral or artificial composition which equals mica in



MICA CUTTING SHOP, LAURENTIDE MICA COMPANY

working force, consisting in the busy season of from 500 to 600 persons. Another big electrical company is working with a few hands only, while the other mica-cutting establishments—Blackburn, Wallingford, Comet, Munsell and others—have either reduced their forces or have shut down altogether. Blackburn Brothers, the most prominent mica producers in the Perkins Mills district, 15 miles northeast of Ottawa, who used to employ between 70 and 80 people at the mines, and the same number at their cobbing and cleaning establishments at Ottawa, have closed down mine and shop. The only mines working at present are the Wallingford, which has now a small force only, and the O'Brien-Plaunt mine, both located near Perkins Mills. It is reported that the Wallingford people have discovered a strong lead of mica crystals, yielding from 1½ to 2 tons of run-of-mine mica per week.

The O'Brien-Plaunt mine, is the old Post phosphate mine, and is about two miles from Perkins Mills. About 20 men are at work, and two pits are under development, the principal one having a depth of 110 ft. Both pits are in the regular pyroxene formation and promise well for the future.

Large quantities of mica were raised during 1907 from the Lacey mine at



LACEY MICA MINE, NEAR SYDENHAM, ONTARIO

States, and mining and cutting plants will resume their usual activity.

The mica mined principally in Canada is the so-called amber or phlogopite quality; whether this mica comes from Ontario or Quebec, it possesses great flexibility, infusibility, and softness. Large sized sheets are less in demand now, owing to the introduction of the manufact-

ured mica in a sheet is replaced by foreign material—in the case of manufactured plates, shellac, or some other cementing material—the more its original qualities must be reduced.

However, it must be said that the building of mica plates has put the Canadian mica industry on an entirely different

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footing; many mines which could not be worked with a profit 10 years ago owing to the impossibility of disposing of the small-sized mica, are now in a far more favorable position, on account of the entirely different market, which demands sizes from 1x1-in. up.

Canadian mica has been introduced into the markets of Great Britain with some success; in the European market, however, it has a strong competitor in Indian mica. Trial shipments made to France and Germany have not satisfied the dealers, partly on account of the mode of preparation and partly on account of terms of payment for the consignments. At present the bulk of the Canadian amber mica is sold to the United States.

Development of the Cyanide Process for Silver Ores in Mexico

BY BERNARD MACDONALD*

Until within the last few years the extraction of silver from the dry ores of Mexico, amounting probably to \$4,000,000,000 since the Spanish conquest, was effected by the patio process, discovered by Bartoleme Medina at Pachuca in 1557. In the United States the same class of ores has been treated by a modification of the patio process known as the Washoe or pan-amalgamation process. The pan-amalgamation process was perfected in Virginia City, Nev., in the early fifties and the entire bullion production of that famous district, amounting to about \$500,000,000, 70 per cent. of which was silver, was extracted by this process, as was afterward (until the market price fell below the cost of production) almost all the silver produced from similar ores throughout the mining regions of the United States, except the amount produced from the high-grade ores which, owing to the high percentage of extraction, were more profitably smelted. The average cost of treatment by this process ranged from \$6 to \$9 per ton of ore, with a recovery obtained ranging from 60 to 75 per cent.

The average cost of producing silver in the United States is stated in the Mineral Industry, Vol. III, of 1894, to be 77.5c. per ounce. Therefore, as the price of silver decreased, it finally became impossible to mine an ore for silver alone and in late years silver has been produced mainly as a by-product in the smelting of gold, copper and lead ores.

It is doubtful if there are half a dozen silver mills, of the hundreds that formerly used the pan-amalgamation process, now running, nor is it at all probable that another silver mill using this process will ever again be erected in the United States. The pan-amalgamation or Washoe process is practically no longer used.

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In Mexico, too, the extraction of silver from its ores by the patio process is now almost totally abandoned because, as in the case of its offspring the pan-amalgamation process, the cost of producing silver from the ores suitable for that process, except in cases of unusually high-grade ore, is higher than the market price of the metal contained in the ore.

When the patio process was in operation at Guanajuato prior to 1900, its cost amounted to \$13.45 per ton, which is about the average cost of the operation of the process as now carried on at Pachuca.

The details of the cost of treating ores by the patio process in Guanajuato are given in a paper, by Robert Fernandez, read at the meeting of the American Institute of Mining Engineers, held at New York in February, 1899, from which the following statement is taken:

"The following is the exact cost of treating the ore in the *Hacienda De Luna* during a period of six months in which 2531 metric tons of ore, carrying an average of 1.123 kg. of silver per ton, were reduced:

General expenses of management	\$0.58	
Coarse crushing	\$0.69	
Fine grinding in <i>arrastres</i>	1.28	1.97
Manipulation in <i>patio</i>		0.44
Washing in settlers and retorting	0.39	
Assays	0.28	
<i>Plantilla</i>	0.20	
Direct taxes	0.38	
Sundries	0.85	2.10
Fodder for mules		3.93
Quicksilver	2.34	
Sulphate of copper	0.77	
Salt	1.32	4.43
Total cost per ton		\$13.45

In addition to the cost of treatment, the cost of mining and sorting the ore, with the care necessary to bring it up to a grade and cleanness from waste rock necessary for the success of the patio process, ranged from \$12 to \$20 per ton; so that the total cost of mining and sorting the ore and treating it by the patio process must have amounted to from \$25 to \$30 per ton and perhaps much more.

When the dry ores were not of sufficient grade to justify this cost the silver mines throughout Mexico were closed and allowed to fill with water. All the mines of Guanajuato were closed down when purchased a few years ago by the American companies now operating them. Thus the mining industry, here in Guanajuato where it has made a world record, died from inanition when former methods ceased to solve the problems of economic production.

At the present price of silver only the methods of production combining the greatest efficiency and economy will be commercially successful in treating low-grade ores. For this reason the patio process has been abandoned, and cyanidation is used exclusively in this district, nor would success be possible by any

other method of treatment now known.

The era of the patio process, which has covered three and a half centuries and enriched the world by billions of dollars, has come to a close. For the reasons enumerated it may reasonably be inferred that the production of silver will hardly meet the normal demand and the price in consequence should advance.

BEGINNING OF THE CYANIDATION ERA

The pioneer foreign company to enter this district since it was abandoned by the English companies in 1848 was the Guanajuato Consolidated Mining and Milling Company. This company purchased the Sirena group of mines in 1908. As work had been suspended for some years prior to the purchase of this group of mines, the workings were in ruins and full of water. The company unwatered the mines and erected a stamp mill using in connection therewith the pan-amalgamation process, and commenced the mining and treatment of the ores. It was found that very little payable ore was blocked out or accessible in the mines, and the vein had to be explored to find new deposits.

At that time many extraneous difficulties were encountered that would not now exist in a similar undertaking in this district. The electric power now furnished by the Guanajuato Electric Power Company was not then in existence. Power had to be generated by steam, using coal (which was not always obtainable), costing 20 pesos per ton. Capital for development and equipment was difficult to obtain, for the opinion abroad was that the mines were worked out when abandoned by their former owners; besides the question was asked how, if silver mining was no longer profitable in the United States, could it pay in Mexico?

For some time after the mill was started it made a fair recovery from the ores coming from the upper levels, but, as new levels were opened at greater depth, amalgamation became less efficient and, in the end, the extraction on ores from the deep levels amounted to only about 60 per cent. The low price of silver that prevailed then and the low percentage of recovery possible to make by pan-amalgamation induced the company to search for a more efficient and economical process.

In 1902, the company engaged the Chas. Butters Company to test the ores by the cyanide process. The test was made in a small testing plant on the ground under the direction and supervision of E. M. Hamilton. The experiments were successful, and the ore was officially pronounced by the Butters company well adapted to treatment by the cyanide process. But at that time the cyanidation of exclusively silver ores on a commercial scale was scarcely heard of, and the common knowledge that the recovery of the silver from gold ores treated

by that method seldom amounted to more than 30 per cent., together with the fact that the ores in the deeper levels were becoming more and more rebellious to treatment by amalgamation, gave grounds for fear that cyanide treatment would not be successful on a commercial scale.

For these reasons the company hesitated to begin an undertaking that involved the expensive experiment of a new plant and a new method of treatment; so the project was dropped.

PAN-AMALGAMATION ABANDONED

As time went on, however, it was finally demonstrated that very little if any profit could be made from the large bodies of low-grade ores that were then

department of the mill be continued in operation until the success of the cyanide plant should be demonstrated.

The plant was erected and went into operation in February, 1905. This plant has the distinction of being the first cyanide mill in Guanajuato.

The results of its operation were satisfactory from the beginning and another unit has since been added to the plant, which brings its present capacity up to 8000 metric tons per month. To the efficiency and economy of this plant is due the present satisfactory and profitable operations of the company, which would not be at all possible by any other process with the present low price of silver.

Since this plant was installed and after

Marketing Zinc Ores

By W. G. MARTIN*

In view of the fact that the production of zinc ore and zinc concentrates has become in the past few years so important to the mine operators in the western States, and as there seems to be almost a general lack of knowledge as to the value of zinc products it may be interesting as well as instructive to compare different schedules used in the payment of both low-grade and high-grade zinc ores.

In the Colorado mining camps, especially the San Juan, Leadville, Montezuma and Breckenridge districts, it will become necessary to handle the zinc so as to make

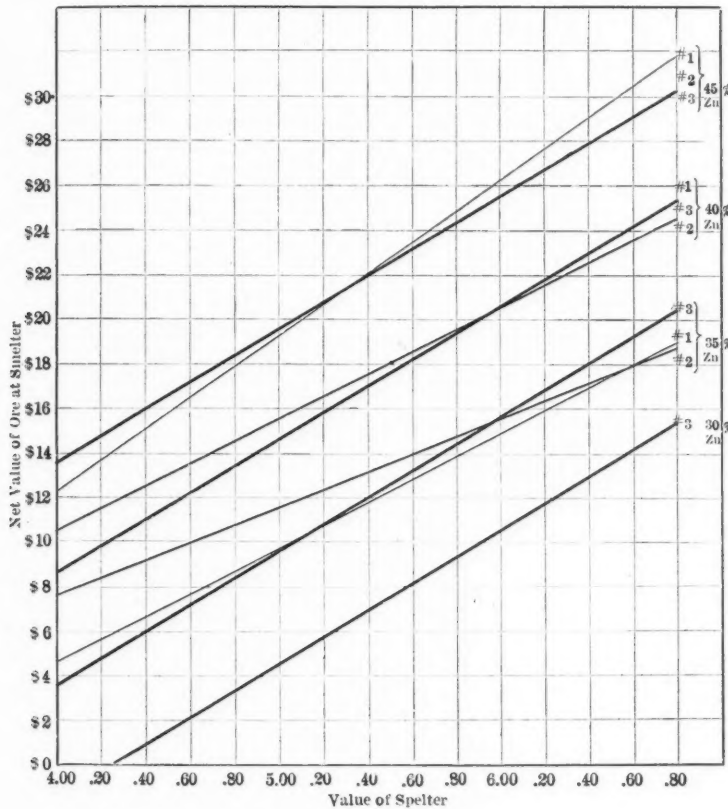


FIG. 1 VALUE OF ZINC ORES

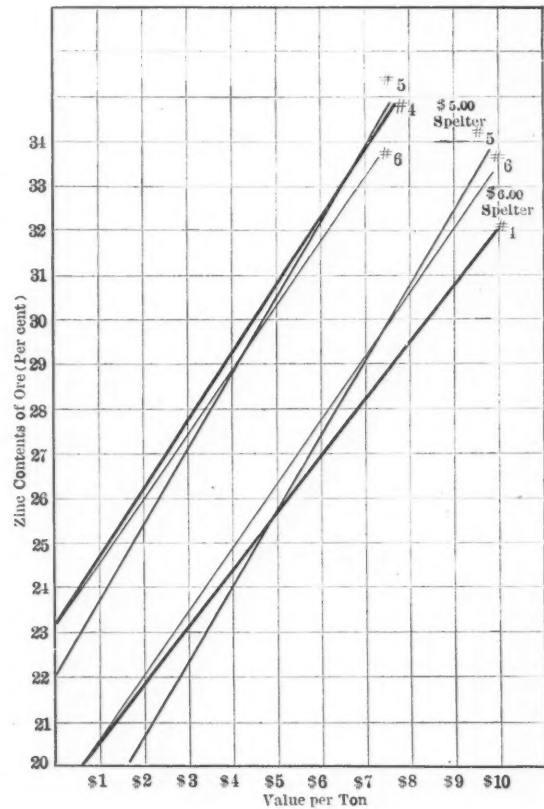


FIG. 2

developed in the mine, by pan-amalgamation, and in March, 1904, I was commissioned by the company to make a thorough examination of the mine and to test again the ores by the cyanide process.

The results of the examination and tests were such that I was enabled to report favorably as to the permanent character of the ore deposits and to advise strongly the substitution of cyanidation for the amalgamation process then in use.

The company decided to act on this recommendation forthwith and commissioned me to design and erect a cyanide plant with a daily capacity of 150 tons, but ordered that the pan-amalgamation

the successful cyanidation of silver ores had been established, a large amount of foreign capital has been invested in the district and all the famous old mines have come under the ownership of 10 or 12 American companies. These companies have equipped their properties with modern plants of mining and milling machinery and there are now 600 stamps dropping in the district, having with their cyanide departments an average capacity of 1800 tons per day.

Thus a new era of silver metallurgy has been ushered in and firmly established, and pan-amalgamation and its prototype, the patio process, from this time forward will occupy an honorable place in history but will probably never again be used.

it one of the resources of the mine where it has been considered a detriment, thus insuring longer life and increasing returns. Regardless of the methods that may be employed to produce this result, a case was recently brought to my attention where a middling product from table concentration, usually thrown on the dump, was raised in zinc tenor at slight expense, and while carrying only little precious metal, netted \$10 per ton at the mill.

For prices paid for western ores of a smelting grade, I have given three schedules, Nos. 1, 2 and 3, and have plotted them (Fig. 1) so as to show how the

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value of the ore varies as the price of spelter varies, and also to show how the value varies on different grades of ore should schedules Nos. 1, 2 and 3 be used as a basis of settlement. These schedules are for ore f.o.b. smelting point (Kansas common points) and may be accepted as prices actually in use. It is understood that these prices may be cut should an ore be objectionable due to either the presence of lime, a high percentage of iron, or silica, or should its physical condition be such as to cause an abnormal loss in smelting. On the other hand a smelting company may pay slightly more for a very desirable ore.

Referring to Fig. 1 and the line representing schedule No. 1, it will be seen that there is a regular decline or increase in the value of the ore of different percentages of zinc as the value of spelter varies. This is due to the variation of six cents per ton of ore of all grades for each variation of one cent per 100 lb. in the price of spelter. It will be observed that this regularity is not true in regard to schedule No. 2. In this quotation, for 45 per cent. zinc ore, the variation per ton of ore amounts to six cents for each one cent variation in spelter price and therefore coincides with schedule No. 3 for all values of spelter. On 40 per cent. zinc ore, however, the variation amounts to only five cents for each one cent change in spelter price, and for 35 per cent. zinc ore to only four cents per ton of ore. Considering schedule No. 1, which is of the form used abroad for the settlement of zinc ore, we find the variation per ton of ore amounts to slightly more than seven cents for each variation of one cent in spelter for 45 per cent. zinc ore, slightly over six cents for 40 per cent. zinc and slightly over five cents for 35 per cent. zinc. Therefore for 40 per cent. zinc ore schedules Nos. 1 and 3 very nearly coincide and are plotted as being identical.

It will be readily seen from Fig. 1, that when spelter is below \$6 per 100 lb., ore carrying up to 45 per cent. zinc will net the mine a better price on schedule No. 2 than on No. 1 or 3, while with spelter above \$6, schedule No. 3 gives higher returns. Also, when the zinc tenor is above 45 per cent. the mine will receive a higher price if schedule No. 3 is used as a basis of settlement.

To find the value of ore of other percentages of zinc than shown in the diagram between the limits of 30 and 45 per cent. zinc for any specific quotation of spelter, one can interpolate the difference from the two nearest percentages of zinc shown to within 10 or 15c. per ton of the correct value.

On quotations of a similar form but of a different base price from the above, the diagram may be used by determining the net value of the ore and adding or subtracting the difference in the base price.

In the sale of low-grade Western ores

for milling purposes we find that the schedules are quite different. This is natural, for while the milling companies produce a zinc concentrate that usually meets with a ready sale at prices approximately as shown in Fig. 1, nevertheless, the loss in milling is heavy and the silica-iron-tailing product carrying from 7 to 14 per cent. zinc, finds little sale and usually goes to the dump as waste material.

Schedules Nos. 4, 5 and 6 are used in the sale of low-grade milling ores and are plotted on Fig. 2, so as to show instantly and clearly how the price varies as the grade of ore varies, as the price of spelter varies, and, also, how the different schedules differ on ores of the same zinc tenor.

It will be seen that ore sold on schedule No. 5, basis of \$6 spelter per 100 lb., will bring a better price up to 25.5 per cent. zinc than schedule No. 4, and up to 30 per cent. zinc will bring a better price than schedule No. 6, beyond which points schedules No. 4 and 6 respectively, net higher returns. However on \$5 spelter, schedule No. 4 gives higher returns than No. 5 only after the grade of the ore reaches 33.0 per cent. Schedule No. 5, of course, gives increased returns over schedule No. 6 on ore containing above 30 per cent. zinc and smaller returns on ore carrying less than 30 per cent. zinc regardless of the price of spelter.

SCHEDULES FOR CALCULATING THE VALUE OF ZINC ORES.

No. 1.—Value of ore per ton equals $[0.95 P (T - 8) \div 100] - R$, in which P is the value of spelter per ton; T is the per cent. of zinc in the ore; R is the returning charge per ton, here used as \$15.98 for all grades of ore carrying from 35 to 45 per cent. zinc.

No. 2.—Value of ore per ton is \$20.50 for 40 per cent. zinc, basis of \$6 spelter, \$1 per unit of zinc up or down, variations as follows as price of spelter per ton varies:—

Per Cent. Zinc.	Per Cent.
35-36 add or deduct 20	variation spelter value.
36-37	21
37-38	22
38-39	23
39-40	24
40-41	25
41-42	26
42-43	27
43-44	28
44-45	29
45-46	30

No. 3.—Value per ton of ore, \$15.50 for 35 per cent. zinc, basis \$6 spelter with variation of six cents per ton up or down for each variation of one cent. market quotation per 100 lb. spelter, and \$1 per unit up or down for each variation of one per cent. in zinc contents.

No. 4.—Value of ore per ton equals $(13 \times T \times P) - R$, in which T is the units zinc in ore; P is the St. Louis quotation spelter per pound; R is the returning charge per ton, here used as \$15 for all grades.

No. 5.—Value per ton, \$7.60, basis \$6 spelter for 30 per cent. zinc with variations of 60c. per unit zinc up or down, also variations as follows as price of spelter ton varies:—

Per Cent. Zinc.	Per Cent.
26-27 add or deduct 10	variation spelter value.
27-28	11
28-29	12
29-30	13
30-31	14
31-32	15
32-33	16

No. 6.—Value per ton, the same as No. 5, except that the ore is paid for with variations of 70c. per unit zinc up or down from a base of 30 per cent., instead of 60 cents.

Use of Litharge in Fire Assaying

B. M. Snyder (*West. Chem. and Met.*, III, 125-129) advocates the litharge method of fire assaying. The method has many advantages over the "nails" method or the scorification method. The slag produced is very fluid, consequently the separation of the slag and lead is cleaner and the danger of mechanical loss due to lead sticking to the nails, or of lead sticking to pieces of nails in the crucible is avoided. In the treatment of impure ores the method is particularly efficient, but has the drawback that while the gold recovery is practically complete, the silver recovery is good only when special precautions are used. In order to obtain this object, one or more crucibles of coal are placed in the closed muffles with the fusions and the reducing atmosphere thus produced, reduces enough lead to cleanse the slag.

The separation and slagging of copper is more nearly complete with the litharge method than in any other method involving only one treatment. For instance, in treating 0.1 a.t. of a 50-per cent. copper matte with 8 a.t. of litharge, an elimination of 88 per cent. of the copper content was obtained. The cost of fluxes is higher with this method, but the most serious objection as the author points out, is the danger of lead poisoning when such large amounts of lead oxides are used. Three stock fluxes are all that are required, as follows: For silicious ores containing over 50 per cent. silica, 24 parts litharge and 2 parts each of sodium and potassium carbonates; for basic ores, 24 parts litharge, 2 parts each sodium and potassium carbonates and 3 parts silica, and for mattes, 32 parts litharge, 1 part each sodium and potassium carbonates and 2 parts silica.

A small amount of alkali carbonate and silica improves the slag, lessens the crucible corrosion and makes a cleaner, more coherent lead button. With ores, 0.5 a.t. is mixed with 4 to 5 a.t. of flux, using reducing or oxidizing agents as necessary and the whole covered with salt. The crucible is placed in a muffle at a low red heat, which is gradually raised during 40 minutes, when the crucibles are ready to pour. The method for mattes differs only in that 0.25 a.t. portions are used, and mixed with 8 to 9 a.t. of matte flux. In assaying copper bullions 0.1 a.t. portions are mixed with 0.8 gram sulphur and covered without mixing with 8 or 9 a.t. of matte flux and salt. The resulting lead buttons are combined, five and five, in scorifiers, and scorified until clean.

The silver mines of Mexico and the copper mines of Lake Superior are the only two undisputed instances of metal mining in America prior to the arrival of white men.

The Moose Mountain Iron Range, Ontario

By J. J. BELL*

The Moose Mountain iron range extends northwest from Lake Wahnapiatae, in the district of Nipissing, to lake Onaping, in the district of Algoma, Province of Ontario, a distance of nearly 40 miles. About 25 miles north of Sudbury it spreads out to a width of several miles. The existence of iron ore in the locality was known in a general way for some years. In the nineties prospectors for gold on the Vermillion river made portages across the iron ridge at the point now known as Iron Dam. In 1902 some Sudbury pros-

and the following assay by Professor Coleman which appeared in the Ontario Bureau of Mines report for 1904, will give an idea of the character of the ore. Iron, 62.64; phosphorus, 0.011; sulphur, 0.056; titanium, none. The ore is a hard magnetite and contains more metallic iron than the Lake Superior ores.

Buildings and machinery have been installed at Moose Mountain and mining is being actively carried on. When the season of 1908 opens, it is expected a train-load of ore will be shipped daily.

Extensive preparations are being made at the Keys, a commodious and safe harbor on Georgian bay, to which the ore will be shipped. This will involve a rail haul of only 80 miles, a shorter distance than the Minnesota ores have to

on another belt to a trestle 60 ft. above the water, where it will be held ready to be shot into the vessels. R. M. Pratt, who built the elevator and coal docks at Port Arthur, is in charge of the construction works at the Keys.

The ore will be shipped to Cleveland and other United States ports, but it is in contemplation to establish blast furnaces at Toronto, and other iron industries will doubtless follow. Mackenzie & Mann, who control the Canadian Northern, have applied to the city authorities for 350 acres at Ashbridge's bay, and though the financial depression has put a temporary check on the project, it seems reasonably certain that a blast furnace will be built before long, and that other iron industries will follow. The distance from



GENERAL VIEW OF MOOSE MOUNTAIN MINE

pectors, through Chase S. Osborn, of Saulte Ste. Marie, interested John W. Gates, of New York, and others, and the value of the ore being established, steps were taken to secure railway connection with Georgian bay. This has now been established. The Moose Mountain iron deposit occurs in rocks of Keewatin age which is the oldest series known in that part of North America. Three deposits have been opened up, the first a lens of magnetite, which has been tested by two drill holes, 257 and 400 ft. respectively, run at angles of 45 and 60 deg.; the second a large orebody half a mile distant; and the third a promising lens a quarter of a mile from No. 1. Analyses have been made of a number of samples,

be hauled to reach Lake Superior. The distance from Sudbury, where connection is made with the Canadian Pacific Railway, is 35 miles. This section of the railway was completed early in 1907, and the remaining 45 miles to the Keys will be ready in the spring of 1908. A six-mile branch will connect the Keys with the main line of the Canadian Northern Railway to Toronto.

Docks are being built at the Keys, the dock plant to have a capacity for handling 8000 tons per day of 10 hours. The depth of water at the docks will be 24 ft. There will be a trestle a mile long, on which the loaded cars will be run up. The ore will be dumped into pockets, from which it will be carried on a rubber belt conveyer which runs through a tunnel cut in the rock, and then elevated

Toronto to Moose Mountain by the Canadian Northern is 256 miles.

The Moose Mountain iron deposit was one of the mining locations visited by the American Institute of Mining Engineers on the occasion of the meeting in Toronto last year.

At the Dos Estrellas mine, in the Tlalpujahua district, Michoacan, Mexico, the cost of mining and milling the ore is as follows: Mining, including development, 4.96 pesos; milling, 1.24; cyaniding, 1.70; assaying, 0.07; general expenses, 0.91; taxes on ore, 0.30; total, 9.18 pesos. The ore is a quartz carrying silver both as a sulphide and as a chloride, while the gold occurs both native and included in the silver sulphide.

*Mining engineer, Toronto, Ontario.

On Certain Errors in Computing Ore Values

By HENRY HOBART KNOX*

Superintendents have often remarked on the discrepancy between the results of progress assays in developing a mine and the results deduced from the recovery and losses in treatment. When these differences are constant over considerable areas of vein, it is evident that they must be due to some error in the system of sampling, or else to mistaken deductions from the results. The sources of such discrepancies may be grouped under three heads: (1) Errors in sampling; (2) errors due to heterogeneous composition of each block of ore; (3) errors in computing.

As the first two sources of mistakes have been exhaustively discussed in this JOURNAL, the third alone will be considered here; that is, the errors which may be due to the failure to take into account the more or less regular distribution of

Under these conditions it may be of interest to compare the values resulting from an average of the assays drawn from the perimeter of the block and the values drawn from the mill returns when this block of ore shall have been stoped out and treated. The first quantity may best be expressed by L = average assay of the perimeter and the second quantity by S = the average assay of the block after extraction.

ORE IN REGULAR SHOOTS

Fig. 1 represents a block in which a high-grade ore occurs as a simple pipe, or chimney, the length of which in the drifts is represented by d . The rest of the block is occupied by a low-grade ore; c = the length of each side of the block; m = assay value of the high-grade ore; n = assay value of the low-grade ore; L = average value per ton derived from samples drawn at equal intervals from all the exposed faces of the block; S = the actual value per ton of the block as a whole. Hence

ORE IN BUNCHES OR PATCHES

The second type of occurrence to be considered assumes the ore to be distributed throughout the vein in bunches or patches which, reduced to the simplest form, may be regarded as squares placed at regular intervals. According to Fig. 3 a represents a side of each square which determines the distribution of the patches, and b represents a side of each square patch of ore. The average assay then of samples drawn from all sides of the block,

$$L = \frac{6mb}{12a} = \frac{mb}{2a},$$

whereas the average assay of the whole block,

$$S = \frac{4.5mb^2}{9a^2} = \frac{mb^2}{2a^2}.$$

The ratio then of $L : S = a : b$. From this it appears that when the patches are small in proportion to the area of the block, the average assay drawn from the exposed faces will be relatively too high and will only approximate accuracy when b approaches the dimension of a . When

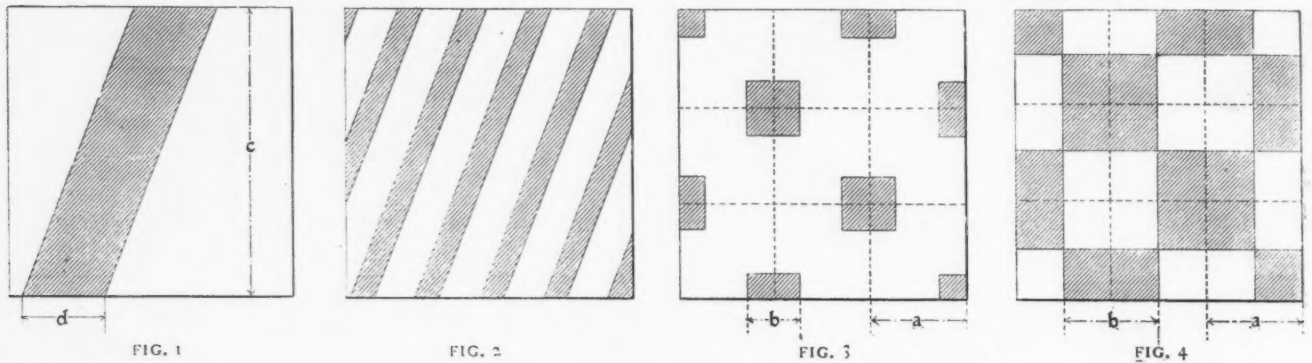


FIG. 1

FIG. 2

FIG. 3

FIG. 4

COMPUTING ORE VALUES

the ore in the plane of the vein comprised within a particular block to be estimated.

DISTRIBUTION OF ORES

In order to study these relations the form of distribution may be reduced to two types. According to the first the pay ore is assumed to occur in regular shoots or streaks; according to the second type, the ore is assumed to occur in patches, the form of which for the sake of discussion will be assumed as square. The width of the vein will be taken as unity and the block of ore to be investigated is supposed to be a square, limited, say, by two levels and two winzes. In Figs. 1 and 2 the shaded portions represent a high-grade ore of homogeneous value, and the blank portions low-grade ore, also of constant value. In Figs. 3 and 4 the shaded portions denote ore and the blank portions barren gangue. The values are thus supposed to be distributed in regular geometrical form uniformly through the block and it is granted that the samples drawn at regular intervals from all sides of the block represent the average value of the exposed faces.

*Consulting mining engineer, New York.

$$L = \frac{2md + n(4c - 2d)}{4c} = \frac{nl + 1(2 - l)}{2c}$$

$$S = \frac{mcd + n(c^2 - cd)}{c^2} = \frac{md + n(c-d)}{c}$$

Take as an example a block 50 ft. square with a high-grade shoot measuring 30 ft. along the drift. Let $m = \$20$ and $n = \$5$, then

$$L = \frac{20 \times 30 + 5(100 - 30)}{100} = \$9.50.$$

$$S = \frac{20 \times 30 + 5(50 - 30)}{50} = \$14.00.$$

The discrepancy in the results varies with the proportion between the high- and low-grade ore and with the difference between the values of the two grades until when $n = 0$,

$$L : S = 1 : 2.$$

This, of course, is a case so simple that the relations would be immediately apparent to the engineer and duly discounted. But the relations would be less obvious if instead of the ideal case considered, the ore occurred in several chimneys. It is, however, plain that the greater the number of streaks in one block, the less will be the error until L and S become practically equal in Fig. 2.

$b = a$, the area occupied by the ore equals the area occupied by barren gangue as represented in Fig. 4, and when this proportion is exceeded, that is, when the distribution may be described as patches of gangue in a field of ore, then the average value of the samples drawn from the perimeter yields an underestimate of the value of the block.

In the foregoing it is, of course, fully recognized that the most carefully prepared assay plan rarely divulges such regularity in the arrangement of values as to permit of the application of mathematics, though in individual cases it may be possible to deduce empirically coefficients by the aid of which a close approximation to true results can be attained. These considerations, however, may serve to emphasize the necessity for carefully scrutinizing the distribution of the ore on the plane of the vein and for making due allowance for the difference between a surface of two dimensions (i.e., the perimeter of the block multiplied by the width of the vein), which is all that the mine samples can represent, and a space of three dimensions, which will represent the ore treated at the reduction plant.

Maryland Mineral Production in 1907

BY WM. BULLOCK CLARK*

There was little change in the total mineral production of Maryland for 1907 as compared with 1906, when the value aggregated \$10,915,472. The statistics collected to date, which are now practically complete, show a value of \$10,940,330 for the 1907 production.

Coal—The coal trade was remarkably good during 1907, the tonnage and value of the product mined slightly exceeding that of the previous year. The production for 1907, the largest in the history of the Maryland field, amounted to 4,937,199 long tons, representing an increase of 84,116 long tons, as compared with that of 1906. The total value of this product was \$6,617,354, which represents a gain of \$142,561. The average price per ton was \$1.34 during 1907, as against \$1.33½ in 1906; the "big vein" coal of the Georges creek valley ranged from \$1.20 to \$1.70 per ton, the average being about \$1.45.

There has been much development in recent years of the "small veins" of western Maryland, both in the Georges creek basin and at points in Garrett county from which coal had not hitherto been shipped. The seams chiefly developed were the Sewickley, Upper Freeport and Lower Kittanning, all of which contain coal of high grade, although the beds are at times thin and faulty. With the gradual exhaustion of the "big vein" of the Georges creek basin it has come to be recognized that the "small veins" actually contain a larger amount of coal than was ever found in the "big vein." Their development will increase the life of the Maryland coalfields by many years.

Building Stone—The stone trade experienced great prosperity during 1907, chiefly on account of the increased use of crushed stone in concrete and road construction. There was some decline in the building-stone trade, including granite, marble, limestone and slate, the chief building-stone products of the State. Granite, with which are included gneiss, diorite and trap, showed a considerable increase in production for the reason above given, while the marble, limestone and slate suffered a decrease. The total value of the stone production during 1907 was \$1,527,177, as compared with \$1,370,924 in 1906, an increase of over 10 per cent. for the year.

Clay—The production of clays and clay products showed something of a decrease for 1907, largely due to the marked decline in the amount of brick and tile burned in the later months of the year when building became less active. The difficulty experienced throughout the year in securing labor retarded production

earlier in the year when the demand was greatest. The total value of the production of clay and clay products in 1907, including brick, tile, pottery, etc., was \$1,863,316, as compared with \$2,178,617 in 1906, a loss of 15 per cent.

Lime and Cement—The production of these materials increased slightly, notwithstanding the fact that there was an almost total extinction of the natural cement business, only one plant being in operation for a short time during the year. The value of the production of lime and cement during 1907 was \$404,794, as against \$383,135 in 1906, an increase of nearly 6 per cent.

Flint and Feldspar—Production decreased over that of 1906; in that year, however, the output was considerably above the normal. The production in 1907 was valued at \$90,860, as against \$126,832 the previous year.

Sand and Gravel—The production of these materials was somewhat less than in recent years, owing to the completion of the filtration plant for the city of Washington, in the construction of which large quantities of sand and gravel had been required. The demand for building purposes and concrete, however, increased. The total value of these products for 1907 was \$277,106, as compared with \$285,797 in 1906 a loss of \$8691.

Ores—The production of the metalliferous ores in Maryland is so small as to affect but little the State's total mineral output. Gold and copper are found in small quantities, and there is generally a small production each year of either one or the other. There has been for many years a fairly good business in local mineral paints, but at the present time there is only one operator engaged in mining and grinding them within the State. Iron ore is much the most important metallic product, but with the closing down of the Muirkirk furnace and the consequent cessation of the mining of carbonate ore there is no production to report from the eastern counties. There was some revival in the mining of the brown hematite ore of the Piedmont district in Carroll and Frederick counties, which are known to contain, at several points distant from the railroads, extensive deposits of this material. The ore was shipped to furnaces in Pennsylvania. The total production of these products during 1907 is valued at \$34,767, as compared with \$15,624 in 1906.

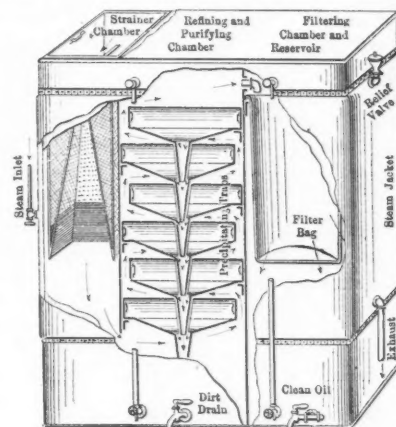
Miscellaneous—The production of mineral waters, which has been gradually increasing in recent years, is valued at \$86,130, as compared with \$58,334 in 1906. The production of soapstone, talc, diatomaceous earth, etc., was not large, and showed something of an increase over the previous year, the value of the entire product during 1907 amounting to only \$35,350.

It is apparent from the brief resumé of the mineral production for 1907 that the

total business was on the average about the same as that of 1906, which showed a material advance over earlier years. Although there was some decline in the building-stone and brick industries, there was a marked increase in production of some other materials, particularly in crushed stone for concrete and road work.

The Franklin Oil Filter

In a new oil filter, manufactured by the Franklin Filter Company, 308 North Commercial street, St. Louis, Mo., the dirty oil enters the strainer chamber, where the coarser particles of impurities are caught, the remainder passing down in the direction shown by the arrows to the bottom of the tank, where the heavy impurities are deposited in the water. The oil then passes under the deflecting wall and flows horizontally over precipitating traps. The impurities which are deposited in each trap as the oil passes over it are permitted to find their way to the bottom of the filter through



FRANKLIN OIL FILTER

the small opening in the bottom of the trap.

The filter is supplied with a steam jacket so that while in the refining chamber the oil is at the proper temperature, to assist in releasing the impurities and depositing them in the traps. After the oil has passed over the precipitating pans it passes through the filter bag, which removes the lighter impurities, and the oil then enters the clean-oil section of the reservoir.

The development of the manganese industry in the central provinces of British India has been rapid. During 1904-05 about 21,000 tons of ore was shipped from the Balaghat district; in 1906 the tonnage had increased to over 60,000, and the 1907 production is estimated to be even larger.

All the antimony oxide used in this country is imported, chiefly from France. The yearly consumption is from 60 to 70 tons.

*State geologist, Baltimore, Md.

Improved Bury Air Compressor

The form of inlet valve commonly furnished with air compressors is made of brass and it screws into the wall of the cylinder or head. Its thread is straight, and since it is depended upon to a great extent for tightness, it is made a good fit in the tapped bore. The guide is made

the tightness being secured by screwing the guide down into a thin corrugated-copper gasket under the shoulder shown. The inside of the guide near the bottom is of hexagonal shape, fitting a special wrench which is furnished with the compressor. The cap which locks the guide has a hexagonal projection which fits the same wrench. On the high-pressure

Positive inlet valves are furnished only on special order, and are placed in the cylinder barrel instead of in the head, as shown in Fig. 3. This leaves the head entirely free from mechanism, gives it the full cooling area, and leaves it light enough to be easily handled by one man. The arrangement of the valves in place is shown in the sectional drawing, Fig. 5.

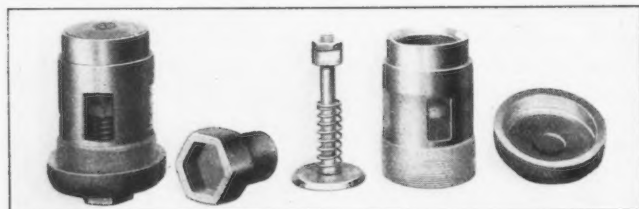


FIG. 1. DETAILS OF INLET VALVE

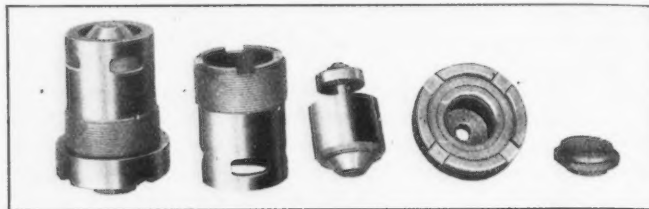


FIG. 2. DETAILS OF DISCHARGE VALVE

of brass to prevent adhesion by corrosion to the metal of the cylinder.

Fully as annoying a trouble is caused by the cylinder-oil which has worked around the thread and become carbonized by the heat of compression to an extent which makes the removal of the guide impossible after a short time by any process short of chipping.

Engineers who appreciate the seriousness of this trouble remove the guides once a week, or so, and clean them with gasolene. This is effective, but the softer thread of the brass soon wears loose from frequent removal, and most engineers will not go to so much trouble even when the circumstances of the use of the compressor make it practicable. The valves and guides used in the Bury air compressor are designed to avoid this difficulty.

cylinder of two-stage machines a copper gasket is also placed under the cap, so that the fit into the cylinder is not depended upon in any way for tightness, and the guide can be removed in a fraction of the time ordinarily required.

In the case of the discharge valve shown in Fig. 2, the guide screws into the discharge passage wall and rests on a corrugated-copper gasket on the cylinder wall. The seat is contained within the

Fig. 4 shows a type of two-stage compressor, as made by the Bury Compressor Company, Erie, Penn. The steam cylinder is simple, having a balanced double-ported slide valve. The whole machine, is rugged, compact and well designed.

The hyposulphite-lixiviation process was introduced at La Dura, Sonora, in 1868; this was the first plant in Mexico to use this process on a large scale.

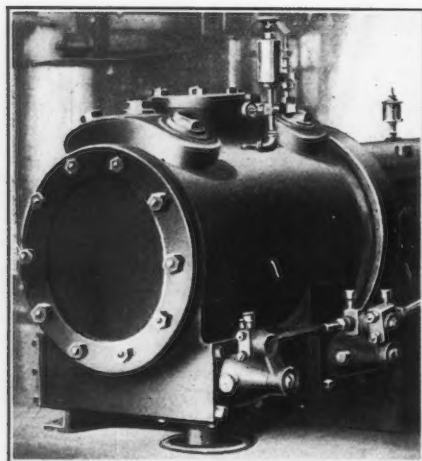


FIG. 3. INLET VALVE IN CYLINDER BARREL

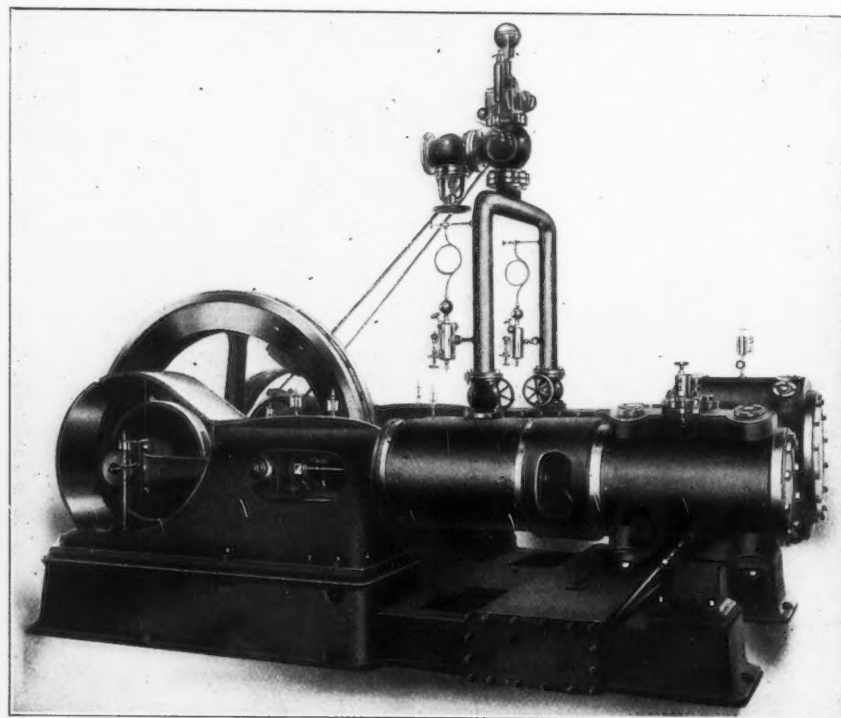


FIG. 4. DOUBLE-STAGE BURY AIR COMPRESSOR

In the inlet valves the guide and seat, shown in Fig. 1, are in one piece, an iron casting which screws into the metal of the cylinder in the cool-air passage wall only. A slight application of graphite and oil when the valve is put in prevents rusting at this point. The portion of the guide entering the cylinder wall is not threaded and is a comparatively free fit,

guide, avoiding all wear upon the cylinder-wall, so that if the seat works loose under the constant hammering of the valve and is not noticed at once, the thread is destroyed not only upon the seat, but often upon the cylinder. The discharge valve being removable, is readily inspected and may be ground in without danger of the entrance of emery into the cylinder.

Presiding at the 10th annual meeting of the De Beers Consolidated mines, Dec. 14, Francis Oats said that the company had 10,000,000 loads of blue ground on the floors, which it would take two years to wash. He declared that the less rich mines belonging to the company could alone produce all the diamonds the world would take.

Some Threatening Conditions on the Mesabi Range

SPECIAL CORRESPONDENCE

Some of the conditions confronting iron-mining operators in the Minnesota regions promise to be exceedingly serious the coming summer. There is no doubt of a material decline in production, caused by the tremendous excess of iron ore now on dock at lower lake receiving ports, taken there last year and as yet unused or uncalled for by furnaces. This decline is variously estimated at from 20

among its settlements. Among the miners was a violent element of socialists and anarchists, which the Western Federation did nothing to curb, indeed, did much to stir up. Some of these men are still in the mining districts, especially of the Mesabi range, where the attempts of the Federation were strongest and where the arm of power was most forcibly exercised to repress their violence.

One element of disorder that has not received the attention it deserves, and which has done much to foster a spirit of anarchy among the miners, most of whom are ignorant of American conditions and American laws, and who are unable to ap-

load, but that brewery shipped to that village during that period no less than 22 carloads, 21 of which were for illegal, or "blind pig" trade. This was nearly 96 per cent. of the sales of this concern in that territory. There is no reason to consider this brewery more successful than its competitors in sales to that class of consumers.

These blind pigs are miners' boarding houses, kept by some Austrian, Finn, Montenegrin, Russian, or south of Europe man or woman, often with children. The unlimited license that is afforded by such quantities of beer as are disposed of in these places leads to orgies of the most inhuman, degrading, obscene and swinish debauchery conceivable. It would be difficult to describe them, even to those who are conversant with the customary conditions of a mining camp. Incidentally, in this atmosphere children grow up. They are degenerates, of course, and they become a tax upon the community if they live long enough. In any event they are useless to the community, weak and pauperized in mind and body. Not long ago six such children were sent from one Mesabi town to the State school in a brief period.

One of the Mesabi communities recently became so aroused over this state of affairs that it sent a committee of leading citizens to interview the brewers' association. This committee consisted of a saloonkeeper, a member of the board of education and a member of the county commission, which latter has charge of the licensing of liquor selling in unorganized territory. The committee was sent out, not to ask for the strict observance of the sumptuary laws, but for what its members considered a reasonable request. They came before the brewers with this statement: "We recognize that beer is considered necessary by these miners; on account of their manner of life, their food, etc., we admit that a certain amount of beer, containing a slight percentage of alcohol, hops, and other properties, may be a food and a digestive agent, and we do not ask you to cut out the sale to illegal places, but we do think that it would be no more than fair if you would reduce the amount delivered to these places to an average of one gallon per man per day!"

One gallon per man per day, in addition to what he might buy in the saloons! And this request was denied. It is only fair to state, however, that in at least one case, since then, the efforts of municipalities to induce breweries to reduce their sales to "blind pigs" have been successful, and that this is likely to be followed by more lawful selling on the part of others.

But the main point is that this indiscriminate violation of law on the part of large interests has its effect on the miners, who are led to the same contempt of the State and municipal regulations of

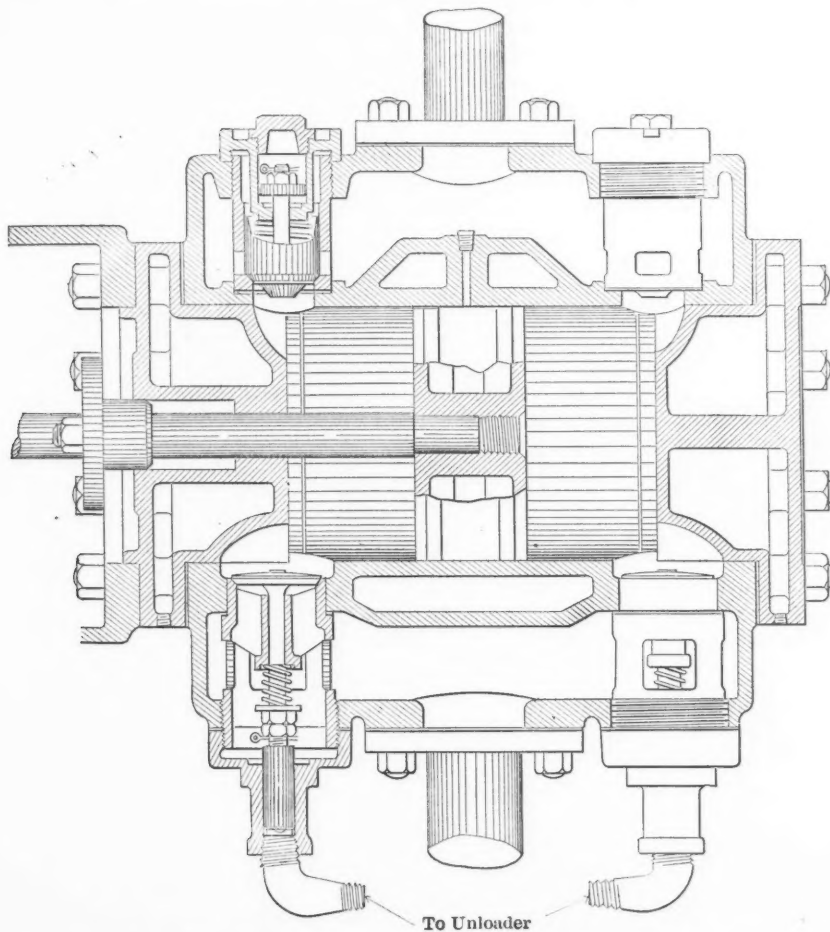


FIG. 5. BURY AIR COMPRESSOR. SECTIONAL VIEW OF VALVES IN PLACE

to 35 per cent. of the business of 1907, which was 42,000,000 tons. Such a drop in tonnage means less men at work, and consequently, under ordinary conditions, more work per day per man, no especial trouble in filling all places, and a lessened number of strikes and labor troubles. All this would seem to augur a more quiet and peaceful season for the operators, and a lack of the friction that has been common of late.

But there was during the early summer of 1907 a serious strike, resulting from the attempt of the Western Federation of Miners to show its control of the situation. This strike lasted a month, and it left a considerable stratum of bitterness

precipitate mildness except as fear, or law except as force, is the liquor trade. The Mesabi range is a hotbed of illicit fermented liquor selling. Practically all saloons on the Mesabi are owned by breweries, located at Duluth and elsewhere. The competition for the sale of beer has become so intense that the brewers, not content with owning saloons, are buying the miners' boarding houses where the illicit sales are carried on. As showing the proportion of legal to illegal beer selling on that range one concrete instance may be given here. One brewery owns three saloons in the village of Eveleth; in these three the normal consumption of beer for a certain period should be about one car-

every nature. Their conception of the principles of American liberty is very crude, and they need the strong hand of militant law.

Not for a moment would I desire to be considered an alarmist, nor as one sounding an unnecessary note of warning; but it is a fact well recognized among the lake iron-mining communities, of the Mesabi range in particular, that a disregard of law, fostered as it has been there, that unlimited quantities of liquor obtainable anywhere and at any time, workmen whose intelligence is of the lowest type and whose passions and hatreds are strong, unguarded towns and ample opportunity for the possession of dynamite, are not the best combination, especially when there is added the bitterness of a recently lost strike, an infusion of anarchism and anarchistic newspapers and too little work to go around.

Mineral Resources of the Republic of Salvador, C. A.

BY SANTIAGO IGNACIO BARBARENA.

It is well known that Salvador has many varied rich mineral deposits, but only recently has attention been given to the mining industry, and some of its mines are now being exploited.

It is not my intention to treat of the mining history of Salvador, but rather to give an idea of the flourishing condition of the country today, and the splendid results obtained in recent years. In order to appreciate these at their true value, it is necessary to make retrospective comparisons which reveal the rapid progress of this industry, and how it is rapidly gaining in importance. Excluding the low coast country, the entire interior of the Republic is rich in minerals, principally the departments of Santa Ana (western mining district), Chalatenango and Cabañas (central mining district) and Morazán, San Miguel and La Union (eastern mining district).

METAPAN DISTRICT

The region of Metapán, in the Department of Santa Ana, is justly famous, being called "la Vizcaya Salvadoreña," owing to its abundant veins of iron, copper, lead and auriferous silver. Iron is practically inexhaustible and is of superior quality. Iron is smelted by the Messrs. Luna in their two plants, San José and San Miguel, by the old catalan process, which is poor in its results. The most notable copper mine is the old El Brujo, the ores of which contain considerable gold and silver. This region has the advantage of a good cart road between the cities of Metapán and Santa Ana, about 56 km. apart; however, if the project of uniting the Salvador line with that of the Guatemala railroad is

realized, or if a branch should be constructed, it would give an immense impetus to the mining industry of the western district.

In the Department of Chalatenango and Cabañas, the mining industry is in its incipiency, the principal and richest property being that owned and worked, in Chalatenango, by Gustavo Lozano. A good cart road has been opened, which facilitates the moving of the products of this district *via* San Salvador, in order to take advantage of the railroad which unites this capital with the port of Acajutla.

The principal mines of the Department of Cabañas are: La Electricidad, Fichan and Los Amates copper mines, belonging to Dr. Santiago Gonzales. Santa Margarita, Santa Angela, La Quebrada, San Francisco and El Zanzo copper mines belonging to Gustavo Lozano, who also owns a bi-oxide of manganese mine. In the Department of Cabañas and in the jurisdiction of San Isidro, are the San Enrique, Cola de Toro, Compañero, Cerro de Avila and Pepita de Oro veins; the last is a porous quartz ore running \$15 gold per ton.

To the southwest of Sesuntepeque are the silver and gold mines known as El Porvenir. The mines of San Fernando, Obrajito, El Dorado and San Juan are also there.

tions of San Carlos and Yamabal are situated in this Department.

In the Department of La Union is the mining district of San Sebastian, rich and well exploited, belonging to an English company. The ore is pyritic, and worked by the cyanide process. El Tabanco mine, belonging to a French company, is rich in gold. Other mines are San Bortolo, gold and silver, belonging to an American company; and Copetillos, also gold and silver. The mines known as La Poza, El Consuelo, Guadalupe, Hormiguero, La Rivera, Gallardo, Esperanza, Potosi, Provenir, are all in the Department of San Miguel, and are rich in gold.

With the preceding brief enumeration of the principal mining centers, a better idea may be obtained of the progress of the mining industry in Salvador by a study of the statistics showing the annual production and export during the past 40 years. In 1864, it may be said that the mining industry was in its infancy, the period preceding this having flourished only indifferently. This period of inactivity continued until 1875, in which year mining assumed some importance. The accompanying tables give the values of ore, gold and silver mined and exported from the ports of Salvador from 1864 to 1875 and from 1901 to 1906; the values are in pesos.

PRODUCTION OF ORES, GOLD AND SILVER, IN SALVADOR, 1864-1895.

(IN PESOS.)								
Year.	Ores.	Silver.	Year.	Ores.	Silver.	Year.	Ores.	Silver.
1864	556	.....	1875	54,560	.....	1886	40,773	149,645
1865	40,826	.....	1876	157,732	(a) 13,248	1887	10,292	(a) 294,795
1866	19,827	.....	1877	56,602	(a) 142,466	1888	.....	(a) 209,313
1867	33,150	.....	1878	71,951	(a) 155,000	1889	10,982	171,264
1868	39,969	.....	1879	67,228	(a) 112,544	1890	2,100	204,747
1869	22,400	.....	1880	.....	.....	1891	45,013	181,446
1870	.....	.....	1881	45,344	105,437	1892	715	149,872
1871	7,180	.....	1882	121,976	82,058	1893	.....	103,000
1872	1,700	.....	1883	39,630	(a) 96,298	1894	27,850	58,464
1873	8,300	.....	1884	.....	.....	1895	730	(a) 20,750
1874	4,200	.....	1885	.....	.....	

(a) Includes some gold.

PRODUCTION OF ORES, GOLD AND SILVER, IN SALVADOR, 1901-1906.

(IN PESOS.)						
Product.	1901.	1902.	1903.	1904.	1905.	1906.
Ores.....	309,074	283,463	1,935,760	(b) 1,501,601	902,506	204,647
Silver, crude and refined.....	96,859	.....	51,343	57,869	227,200	2,376
Gold, crude and refined.....	53,467	4,000	30,144	16,127	652,568	(c) 2,662,092
Silver, auriferous.....	.....	.....	19,588	56,539	139,420	372,550
Totals.....	459,400	287,463	2,036,835	1,632,136	1,921,694	3,241,665

(b) Contains copper ore valued at 601 pesos.

(c) Includes also gold amalgam and gold, silver and copper slimes.

MORAZAN AND LA UNION MINES

In the Department of Morazán, the following mines exist: El Divisadero, belonging to an English company. This company also owns the mines known as La Protectora, El Bosque, Carolina, El Gavilan, etc. The Loma Larga mine, producing gold and silver, is now being worked; El Nance, Orito, Los Santos, San Francisco, El Pique de la Señora, El Socorro, La Perla and others also belong to the same company. Margarita, Montecristo, El Carrizal, La Veta del Gigante, Neuva Virginia and various other gold and silver mines, all in the jurisdic-

In 12 years the total amount exported is scarcely 7 per cent. of the value exported in 1906 (3,041,665 pesos). From 1876 to 1895, the mining industry began to expand, the production being principally silver and not much gold.

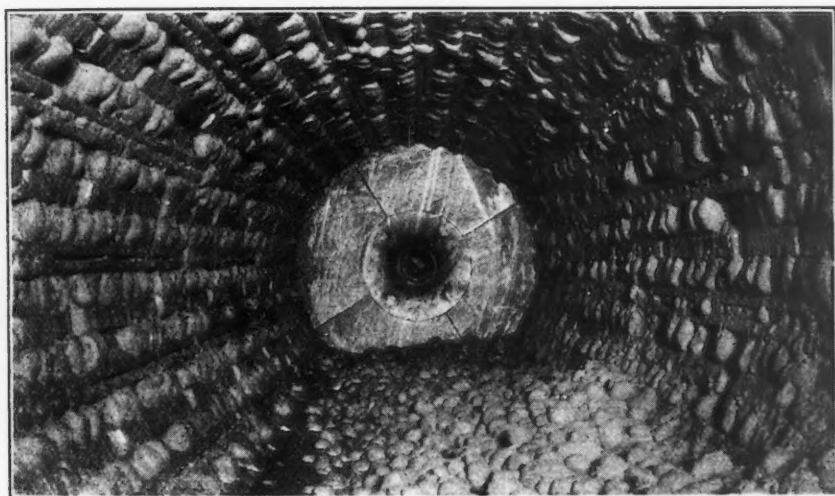
In 1895 the mining industry suffered notable depression; soon it recovered and, from 1901, it improved. During 1906 the metals exported were principally gold.

The accompanying figures speak with sufficient eloquence, and no further comment is needed. The mining industry has grown, from almost nothing, to be one of the principal exports of Salvador.

El Oro Tube-mill Lining

This tube-mill lining, which was invented by J. R. Brown, was perfected at Las Dos Estrellos and El Oro mills at El Oro, Mexico; hence the name. The lining consists of corrugated segments made of white iron or steel, which are bolted to the shell of the tube mill. On the face of each segment are longitudinal ribs, which form two channels; into these the pebbles are wedged by the hammering action of other pebbles in the charge to form the wearing surface of the lining.

The channels are wider at the top than the bottom. Therefore, the pebbles wedge tightly into place, and, as they come in contact with the ribs in more than one place, they do not move any when other pebbles strike them, as might be the case were the channels shaped otherwise. As a pebble becomes worn or fractured, and drops out, its place is taken by a suitably sized pebble; thus the lining rebuilds itself as the pebbles wear away.



THE INTERIOR OF TUBE MILL WITH EL ORO LINING

The rough surface of the lining is an advantage, for it checks the tendency of the charge to slide or skid over the lining when the mill is under-charged.

Some experiments were made at El Oro to determine relative wearing qualities of different linings for tube mills; the working conditions were kept as constant as possible. The mills treated continuously pulp from the stamps, which were crushing quartz ore. Both 20x4 ft. and 24x4 ft. tube mills were used. The linings lasted as long in one size as in the other. The ordinary smooth white-iron lining, 1 1/8 in. thick, lasted 3 months; silex blocks, 2 1/2 in. thick, lasted four months; El Oro linings lasted 10 months.

The Venezuelan Government has recently granted a concession for the mining of magnesite on the island of Margarita.

The Daly West Mining Company

The annual report of the Daly West Mining Company, of Utah, covering the year 1907, has been issued. It shows that 24,856 tons of ore, concentrates and of what is classed as "miscellaneous ores," coming mostly from leasers, were sold for \$771,679. The product was 673,890 lb. copper, 8,086,456 lb. lead, 950 oz. gold, 1,042,042 oz. silver and 5,111,060 lb. zinc. The crude ore averaged 43.13 oz. in silver, 0.0423 oz. in gold, 13.43 per cent. lead, 1.4 per cent. copper, 7.8 per cent. zinc; selling at \$28.51 per ton. The concentrates averaged 54.54 oz. in silver, 0.0408 oz. in gold, 28.15 per cent. lead, 1.53 per cent. copper, 15.4 per cent. zinc; selling at \$48.85 per ton. The miscellaneous ore averaged 30.10 oz. in silver, 0.0321 oz. in gold, 9 per cent. lead, 1.14 per cent. copper, 8.2 per cent. zinc; selling at \$18.23 per ton. The financial statement shows that on Jan. 1, 1907, the company had \$451,310 on hand; the ore

tained in good repair. On account of labor troubles, the mine was closed down from Sept. 25 to Nov. 15. During this time the output of the mine was stopped altogether and expenses cut as low as possible.

Mill Superintendent F. W. Sherman reports that the milling plant was likewise greatly handicapped, the actual running time amounted to 131 days, and a fraction. The mill effected a saving of 99.5 per cent. of the lead and 71.27 per cent. of the silver contained in the ores treated. The plant took care of 479.7 tons of ore during each 24-hour day of service.

The total production of the Daly West mines at Park City from November, 1893, up to Dec. 31, 1907, was as follows: Gold, 116,114 oz.; silver, 19,591,822 oz.; copper, 13,467,032 lb.; lead, 84,893 tons. The metals produced sold for a total of



EL ORO TUBE-MILL LINING

sales during the year were \$771,679, and from other sources, \$5774, making a total of \$1,228,764. There was expended for mine account, \$390,244; ore expense, \$24,104; mill account, \$86,767; assay office, \$3843; general expense, \$20,534; insurance reserve, \$5719; taxes, \$11,466; fire insurance, \$3018; dividends, \$378,000; leaving a balance of \$305,067 on hand Dec. 31 last.

General Superintendent P. L. Williams, Jr., states that 4269 ft. of developing and exploring work was done, 3251 ft. of which was run in drifts, 33.5 ft. in sinking and 984.5 ft. in raising. No further sinking of the main shaft was done on account of the fact that the Ontario drain adit No. 2 has not been opened. However, satisfactory progress is now being made in the opening of the adit and it is expected that normal conditions will prevail again within a very short time. All machinery and buildings have been main-

tained in good repair. On account of labor troubles, the mine was closed down from Sept. 25 to Nov. 15. During this time the output of the mine was stopped altogether and expenses cut as low as possible. The best year in the history of the company was 1903, when earnings were \$2,382,357, and total of \$1,332,000 was paid in dividends.

Coal Production of Austria

Coal production of Austria in 1906 and 1907 is reported as follows, in metric tons:

	1906.	1907.	Changes.
Coal.....	13,473,307	13,828,438	I. 355,131
Brown coal....	24,167,714	26,148,073	I. 1,980,359
Total mined.	37,641,021	39,976,511	I. 2,335,490
Coke made....	1,677,646	1,902,077	I. 224,431
Briquets made	252,364	296,455	I. 44,091

Of the coke reported for 1907 there were 31,897 tons, and of the briquets 159,370 tons, made from brown coal, or lignite.

Sampling and Assaying Spelter

By EVANS W. BUSKETT*

Spelter is generally sampled by drilling two holes in every slab, each about 4 in. from the ends. A great deal depends upon how the sample is drilled and the sampler may cause the assayer much trouble by carelessness. The drilling machine used in sampling spelter, whether driven by hand or power, should have an automatic feed and both the feed and the speed of the drill should be slow. On a high speed and heavy feed the cuttings are too thick to dissolve readily in sulphuric acid, and this retards the assay. On a slow speed and light feed the cuttings come off in very thin spirals which are sometimes 6 in. long. After drilling a number of samples the drill becomes covered with zinc. This is dissolved by placing the drill in a solution of hydrochloric acid. The drill is then washed and is ready for use. Oil should never be used; if the drill shows a tendency to stick it should be cleaned with acid. If it becomes hot, it may be cooled with water. If oil is used it coats the drillings and it is almost impossible to dissolve them in sulphuric acid.

When a lot is sampled the drillings are placed on a large sheet of wrapping paper and broken up into pieces about 1 in. long. These are then mixed and a sample, weighing about one-half pound is taken.

The weighing is generally done on a pulp balance and as a 10-gram sample is taken for assay, an extremely sensitive balance is not necessary. Before weighing, the sample is spread on a sheet of paper in front of the balance, and any particles of iron that may have accidentally fallen into it are removed by a magnet.

ASSAY OF IRON AND LEAD

Every lot of spelter is assayed for iron and lead and where the ore is known to contain cadmium, this element is also determined.

Iron—Weigh 10 grams of spelter into a beaker containing 50 c.c. of water and 15 c.c. of sulphuric acid and cover with a watch glass. It is customary to weigh the last thing in the afternoon and allow the sample to stand over night on account of the slowness of solution. When all the zinc is dissolved there will still be left a sponge of lead and a little lead sulphate. Filter and wash with hot water.

The filtrate, which contains the iron, is tested to see if any oxidation of the iron has taken place. This is done by bringing a drop of the assay into contact with a drop of a solution of potassium sulphocyanide on a spot plate. If any ferric iron is present the spot will turn red. It will

generally be found that no oxidation has taken place.

Boil five minutes and add 100 c.c. of cold water and titrate with a standard solution of potassium permanganate, containing 0.56 gram $KMnO_4$ per liter, until the pink color is permanent; 1 c.c. of this solution will oxidize 0.001 gram of iron. When 10 grams are taken for assay 1 c.c. represents 0.01 per cent. Fe.

Should it be found that some of the iron is in the ferric state it will be necessary to reduce it with zinc. Add about 5 grams of c.p. zinc and boil until a drop of solution brought into contact with a drop of the indicator no longer produces a red color. Filter the solution to free it from zinc and boil for five minutes to drive off hydrogen. Add 100 c.c. of cold water and titrate.

Lead—The residue on the filter consists mainly of sponge lead. Open the filter paper and wash the residue into a beaker and add 5 c.c. of nitric acid. When all the residue is dissolved add 5 c.c. of sulphuric acid and boil until white fumes are evolved. Cool, add 50 c.c. of cold water and boil. Cool, filter and wash with hot water. Place the filter containing the lead sulphate in a beaker and add a teaspoonful of sodium acetate and a few drops of acetic acid. Dilute to 100 c.c., boil and titrate with a standard solution of ammonium molybdate using tannic acid as an indicator.

The standard solution is made by dissolving 9 grams of ammonium molybdate in 1 liter of water; 1 c.c. of this solution will precipitate 0.01 gram lead; when 10 grams are taken for assay 1 c.c. represents 0.1 per cent. Pb.

Cadmium—Weigh 20 grams of spelter into a No. 3 beaker-containing 50 c.c. of water. Add hydrochloric acid from time to time until all but about one gram of the zinc is dissolved. As long as any of the zinc remains undissolved the acid will not attack the cadmium. Filter and wash well with hot water. Wash the residue into a No. 3 beaker and add 10 c.c. of nitric acid. Boil until nitrous fumes are expelled and add 10 c.c. of sulphuric acid. Boil until white fumes are evolved. Cool, dilute, and filter into a No. 5 beaker. Add 7 grams of ammonium chloride and an excess of strong ammonia and filter off the precipitated iron. Neutralize the solution with hydrochloric acid. If any white zinc hydrate is precipitated add enough hydrochloric acid to dissolve it. Heat to boiling and pass in a rapid current of hydrogen sulphide for thirty minutes. If much white precipitate forms, add more hydrochloric acid. The precipitate should be yellow if the spelter contains cadmium.

Allow the precipitate to settle, then filter and wash. Re-dissolve the precipitate in hydrochloric acid and re-precipitate in the manner described above at least three times.

OTHER METHODS FOR CADMIUM

The most accurate method of determining cadmium in spelter is to weigh it as cadmium sulphate as follows: Dissolve the cadmium sulphide precipitate in hydrochloric acid and add about 1 c.c. sulphuric acid. Evaporate to dryness in a platinum crucible or dish and ignite at a dull red heat. It is best to use a bunsen burner or alcohol lamp in order that the heat may not be too great. Weigh as $CdSO_4$.

Another, more rapid but less accurate, method is to dissolve the cadmium sulphide in a solution of ferric sulphate, $Fe_2(SO_4)_3$, containing sulphuric acid and determine the ferrous sulphate reduced, by titrating with a standard solution of potassium permanganate.

Cadmium may be accurately determined by precipitation from a hydrochloric-acid solution with an excess of oxalic acid in the presence of strong alcohol. The solution is filtered and the precipitate is washed with alcohol. Dissolve in hot hydrochloric acid, cool and determine the oxalic acid by titrating with a standard solution of potassium permanganate.

New Districts in California

SPECIAL CORRESPONDENCE

The Palo Verde country in the eastern end of Riverside county, has much developed mineral wealth in the Ironwood and Riverside mountains, and many claims have been located, though little work has been done upon them thus far. The Santa Fé railroad company is building a bridge across the Colorado river at Parker for a cut-off to Bengal or Cadiz, and there is a possibility of a branch line being run from this cut-off through the Riverside and Ironwood districts down into the Imperial valley. This should develop these districts as well as to bring Dale district nearer the railroad. Many thousand mining claims have been recorded in Riverside county in the past six years, but comparatively few of them have been developed.

The gold, silver and copper mines at Cima, in San Bernardino county, are becoming more productive. The Standard Mines Company and Death Valley Mining Company are at present the principal producers, the former being the largest one, shipping its ore to Salt Lake smelters for reduction. This property is well equipped and has a hoisting plant fitted to lift from 1000 ft. depth.

The Bureau of American Republics announces that the Bolivian exportation of tin to Europe and America in 1907 amounted to 15,300 tons, against 16,380 tons in 1906.

*Metallurgical engineer, Peoria, Ill.

Kilbourne & Jacobs Dump Bucket Anti-Debris Activity in California

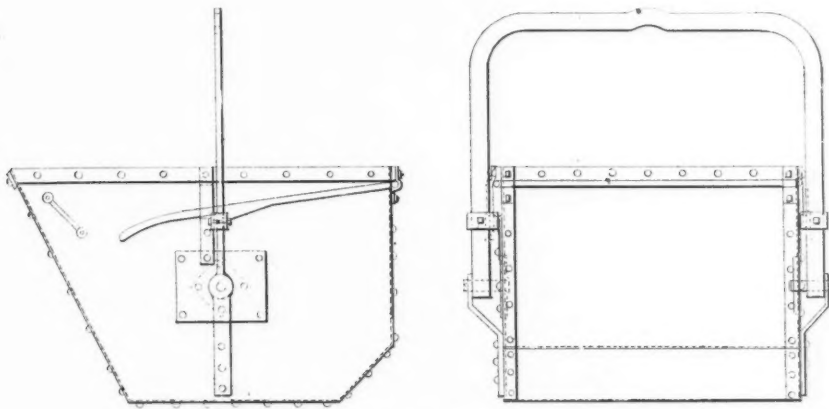
SPECIAL CORRESPONDENCE

A new dump bucket which permits of dumping from either side and, when righted, automatically locks, is manufactured by the Kilbourne & Jacobs Manufacturing Company, Columbus, O. The releasing device consists of a steel arm which extends around the back of the bucket at the top edge from bail to bail.

When the bucket is righted, the shoulders on the steel arm at each side, are in contact with latch-bars which are firmly bolted to the bail, forming a secure latch, thus obviating any possibility of accidental discharge. The ends of the steel arm project to form operating levers.

As was recently predicted, the Anti-Débris Association is showing great activity again in its efforts to prevent hydraulic mining in the drainage basin affected by the Caminetti law, whether the mines operating have a license to hydraulic from the California Débris Commission or not. In fact the association has already gone farther than it ever did before by giving a field committee full charge of all the men in the field, to direct operations at pleasure, and also to direct the attorneys to begin injunction suits against hydraulic

certain "watchmen" of the association—called "spies" by the miners—have made a detailed report of the plans in contemplation for the operation of new mines in the hydraulic-mining region covered by the law, showing that the association is not only attempting to close down old mines, but also intends to prevent any new ones starting up. Under these conditions, in view of the recent decision, there seems little present hope for the the hydraulic-mining industry in the drainage basin of the Sacramento and San Joaquin rivers. The California Miners' Association is no longer in a financial position to take any concerted action, so all injunction suits must be fought out by individual mineowners, or else the mines must close down.



KILBOURNE AND JACOBS DUMP BUCKET

To dump the bucket, the operating lever is raised at either side and both latches are completely released. This arm is placed so as to protect it from any possibility of being struck, bent or distorted in any manner; it is in continuous contact with the bucket and is placed immediately under the steel band with which the top of the bucket is reinforced.

mines, without calling a meeting of the association. This committee consists of David Morrison, of Wheatland, Yuba county, G. H. Graves and E. J. White, of Sutter county. The county surveyor of the latter county, in the employ of the Anti-Débris Association, has made a report of the conditions of mining at Dutch Flat in Placer county, and submitted

DETAILS OF VARIOUS SIZES OF BUCKETS.

Capacity.	Length.	Width.	Depth.	Bail.	Top Band.	Brace Strap.	Plates.	Locking Rod.	Pins.
21cu.ft.	46"	34"	28"	3/8" x 2 1/2"	7/8" x 2"	1 1/2" x 2 1/4"	No. 12	3/8"	1 1/2"
27cu.ft.	50"	3 "	30 1/2"	3/4" x 2 1/2"	1 1/8" x 2"	1 1/2" x 2 1/4"	No. 12	3/8"	1 1/2"
36cu.ft.	54"	42"	33"	1" x 2 1/2"	3/4" x 2"	1 1/2" x 2 1/4"	No. 10	1"	1 3/8"
41cu.ft.	58"	42"	35"	1" x 3"	3/4" x 2 1/2"	1 1/2" x 3"	No. 8	1"	1 3/8"
54cu.ft.	62"	48"	38"	1 1/4" x 3"	3/4" x 2 1/2"	3/8" x 3"	No. 8	1 1/8"	1 1/2"

This device avoids the necessity of the operator being always at one side of the bucket and eliminates intricate or fragile mechanism. The bucket is equipped with a false bottom of sheet steel riveted in place. The front, back and bottom are formed from one continuous sheet of steel and the sides are stamped with a flange through which they are riveted to the front, back and bottom plate.

The zinc-ore production of Prussia in 1906 was 702,932 tons, of which 188,249 tons consisted of calamine and the remainder of blende. The number of workmen employed was 16,366.

drawings, maps, etc., to show the inefficiency of certain débris dams erected under the authority and supervision of the California Débris Commission. As this surveyor of a county which has no mines within its borders, disagrees as to the efficiency of the dams built under the supervision of officers of the Corps of Engineers, U. S. A., the association will bring injunction suits to stop the mines using the dams! This is the direct result of the recent decision of the State Supreme Court, which holds that the license to mine issued by the California Débris Commission gives no final authority to the miner to hydraulic. Moreover,

Gasolene for Engines

Owing to the increasingly important use of gasolene engines at mines far from a fuel supply, the following information given by Amos Hardy (*Iron Age*, Feb. 13, 1908) is interesting.

The specific gravity of gasolene and the time required to volatilize it affect the running of the engine, as well as the ease with which it can be started, especially in a cold climate. A simple test for volatility consists in moistening the hand with it and noting the time it takes to evaporate. Stove gasolene, commercially known as 74 test, which is commonly used in engines, evaporates in about 7 to 10 sec., leaving the surface of the hand perfectly dry. Gasolene of 60 deg. Baumé requires from 1/4 to 1/2 min. to evaporate. If there is any greasy residue left on the hand the fuel is not fit for use in the ordinary gasolene engine.

Liquid fuels of lower specific gravity, down to 56 deg., may be used successfully in the ordinary gasolene engine, although it may become necessary to heat the air before it is brought into contact with the fuel. This can be done readily by inclosing the exhaust pipe with a sheet-iron cylinder 1 to 2 in. larger in diameter than the pipe, and connecting the air supply pipe to this cylinder.

For starting the engine on low-grade fuels, when it is cold, it may be necessary to use gasolene for a few minutes, until the engine has warmed up sufficiently to allow the heavier fuel to be vaporized. The design of the fuel-admission device may have considerable effect on the way in which a low-grade fuel can be used. A number of gasolene engines as now built can use 56-deg. distillate, even for starting at moderate temperature, without the necessity of heating the air.

Mexico has 27 states and two territories. Chihuahua is the largest state; its area is greater than that of any state in the United States except Texas.

A Mechanical Substitute for the Shovel in Coal Mines

BY W. E. HAMILTON*

The production of coal has grown to 400,000,000 tons per year in this country alone; this is about 20 times the total tonnage of our pig-iron mills and like the iron business, the coal trade is peculiarly sensitive to the general welfare of the country.

An industry that calls for a maximum production when the business of the country is at its high, naturally has sought ways to increase the output to supply these unusual demands. The mechanical undercutter in the coal mine, both chain and pick, has in a great measure cut down the laborious work of the miner and at the same time has enabled operators to

Under the room-and-pillar plan of working, rooms from 15 to 30 ft. wide are driven off of the main cross entries. Where the seam of coal is 7 ft. thick and undercut by machines to a depth of 6 ft., each room will produce something like $37\frac{1}{2}$ tons for each time it is so undercut. The present practice is to shoot this coal down, and then with one or two men, load it out with shovels. While it requires only two hours' time to undercut the coal with a machine, it takes nearly two days for two men to load this coal out of the room and to prepare the room to be cut again. The pit-car loader follows the undercutting machine and mechanically handles the coal after it is shot down. The machine does in two hours the work that takes two men two days.

OPERATION OF THE MACHINE

The loader, which is self-propelling,

of 80 ft. a min.; the trough is 12 in. wide and 8 in. deep, and when filled with coal 6 in. deep, loads at the rate of a ton a minute. As the engine or motor is reversible and the sweep feed also reversible, the machine takes coal from the mine floor when moving in either direction, and once the loading is started, there need be no loss of time except for changing cars. A car holding 3 tons can be filled in from 3 to 5 min., but as the coal does not always fall from the shot in a uniform condition, it is necessary to have a man at the front end of the machine to see that the material falls into the path of the machine in as constant a flow as possible.

As soon as the car is filled, the machine runner throws a clutch on the engine, which stops the conveyers and starts the car-puller drum. The car by this means is pulled out to the room neck and the

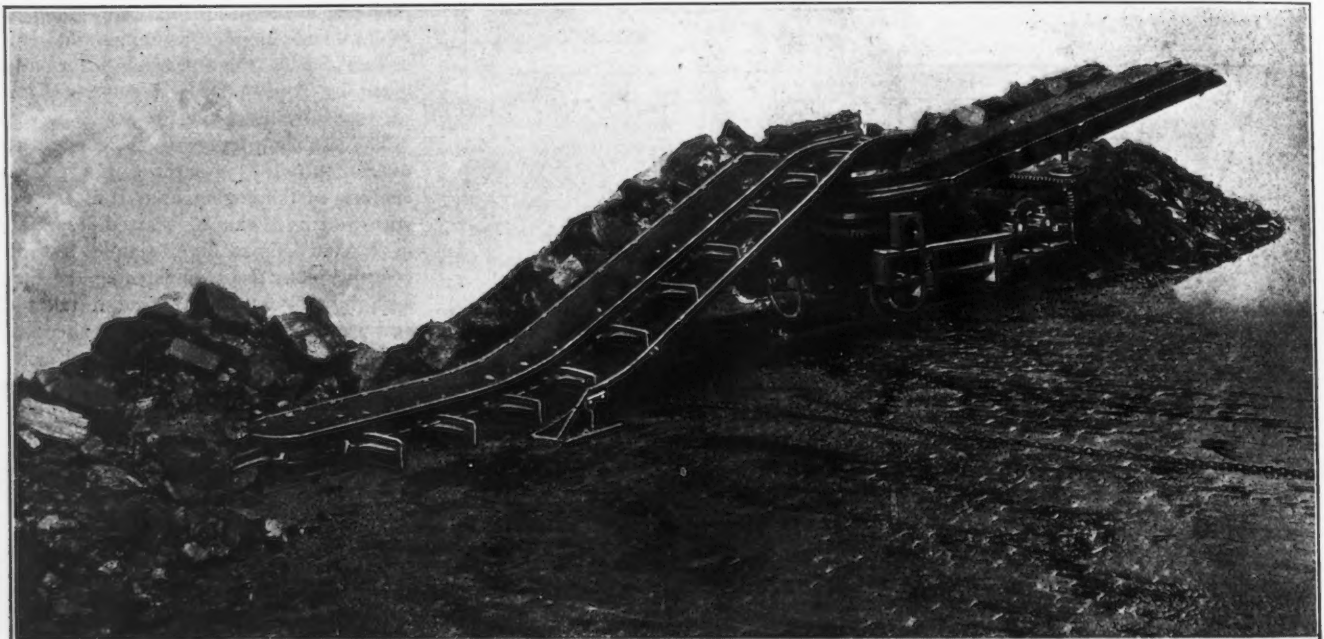


FIG. 1. THE HAMILTON PIT-CAR LOADING MACHINE, READY FOR OPERATION

force the production to a higher point than could have been hoped for had this same work continued to be done by hand.

The undercutting machines, however, perform only a part of the work required to produce a ton of coal; the other and greater part is shoveling the coal into the car after it is shot down. Although there has been need for a machine which would do the loading of the coal, ever since the mining machine was pronounced successful, still nothing along these lines was devised, until the last few years when through the interest of a number of men prominent in the production of coal, we have been able to develop the pit-car loader. I will briefly describe the operation and mechanical construction of this machine, touching on some points connected with coal mines.

*Engineer with the Hamilton Manufacturing Company, Columbus, Ohio.

and operated by either air or electricity, moves into the room and the front end is unloaded from the pony truck, the latter is pushed out of the way until the next move of the machine is to be made. The anchor posts are then set with their tops in the roof inclining toward each other, and the feed chain is fastened to the foot of each post. The machine is then ready to operate as soon as a car is placed in position to be loaded at the rear of the machine.

In gathering the coal, the universally mounted sweep is pulled one way or the other by the feed chain, and the nose, which is 4 ft. long, digs into the coal pile; the flights on the conveyer chain drag the coal up into the trough of the conveyer and deliver it to the second conveyer, which, in turn, delivers it to the car, (see Fig. 2).

The conveyer chains travel at the rate

rope after being detached, is brought back to the switch block on the machine and carried to the empty on the siding. This is a method that has been worked out to handle the heavy cars that ordinarily require a gathering motor to do the shifting in the rooms. The sketch shows the method of handling both the machine and the mine cars.

The capacity of the machine up to 40 tons per hour is limited only by the number of cars which can be brought to it and taken away in the hour. While a 3-ton car has often been loaded in 3 min., if we make the average 5 min. and allow 4 min. for switching, or an average of 9 min. per car, we have 20 tons per hour or 120 tons loaded in six hours. This allows two hours for moving from one room to another; it takes about 20 min. to make a move. As the machine never leaves the track, the work of moving con-

sists of putting the gathering end on the pony truck, which is accomplished in 5 min., and running the machine by its own power to the next working place.

The delivery conveyer of the machine is properly called the picking table, as it affords an opportunity to clean the coal as it passes on to the car. The man at the front end can also clean the coal from the slate and bone as it enters the machine. The machine has worked in a 5-ft. seam from which 10 in. of dirt had to be cleaned. The delivery conveyer is also universally mounted, and can be raised and lowered, or swung to load cars at the side of the machine as well as at the rear.

As shown on the layout here illustrated (Fig. 2), the track for the loader should be in the center of the room. A siding at the room neck should also be provided so that car service to and from the machine may be as nearly continuous as possible. The rooms should be worked in rotation and this work so arranged that the undercutters, the drillers and shooters, the timber and trackmen, would each do their separate part of the necessary work to keep the rooms ready for the machine. This specializing of labor is in line with the latest coal-mine practice and will make each branch of the work more efficient.

The machine picks up coal from the mine floor at the rate of from 1000 to 2000 lb. a min., leaving the floor as clean as if swept by a broom. The machine's daily capacity is dependent upon the supply of coal that is ready to be loaded, and upon the prompt delivery of the empty cars to the machine and the equally prompt removal of the loads. General experience with the loader has resulted in the adoption of the system here outlined to secure the full benefits of mechanical loading.

COST OF LOADING

The present cost of loading coal in mines runs from 18 to 40c. a ton. The scale or rate for this work varies according to the conditions under which the men work, and it is also usually higher in union than in non-union mines. The average workman, where conditions are favorable and where he has no other work to do, will shovel about 10 tons of coal per day; and at the scale price of 18c. per ton, will make about \$1.80 per day. In other districts where the roof is bad, and where there is more or less bone coal and top slate to handle, the rate is often as high as 35 and 40c. This usually includes the drilling and shooting of the coal, which part of the work, when separated, can be done for about 3 or 4c. a ton. The machine loads run-of-mine coal at a cost of less than 10c. a ton for the loading, paying the machine hands better wages than the hand-loader earns. The cost to the operator will be cut from 25 to 50 per

cent., depending upon the original scale paid for the work.

A mine producing 1000 tons of coal per day, under the present system of hand-loading, would probably have 200 rooms opened up ready to work, although one-half of this number, or 100 rooms, will produce this coal if that many men could be relied upon to regularly report for work, each man so reporting to load out his quota of 10 tons a day. Mine statistics show that the average shoveler loads about 8 tons per day. At this rate, 120 rooms would be required, besides an extra number of rooms in which the undercutters and the drillers and shooters would be working, making in all about 150 rooms for an output of 1000 tons per day.

In the machine-loading system, the number of rooms necessary for this output would be cut down more than one-half; and in many localities the number of rooms required can be reduced two-thirds from the number needed for hand-loading.

the moderation of the statement that we can reduce the number of working places by one-half.

ADVANTAGES OF MACHINE-LOADING

Aside from the saving in the actual cost of loading, there results the following indirect advantages and economies, incident to this reduction of the working territory required for a given output of coal:

It is manifest that in the greatly reduced mine territory which is the logical sequence of the introduction of machine-loading, that ventilation will be proportionately reduced in cost; it will also be more easily handled and more surely depended upon. In this connection, I wish to call attention to some facts which are greatly in favor of the use of this machine. The flights of the conveyer gather the coal from the room floor with the least possible breakage and disturbance. They convey the coal into the car at the slow rate of 80 ft. per min., or one-third

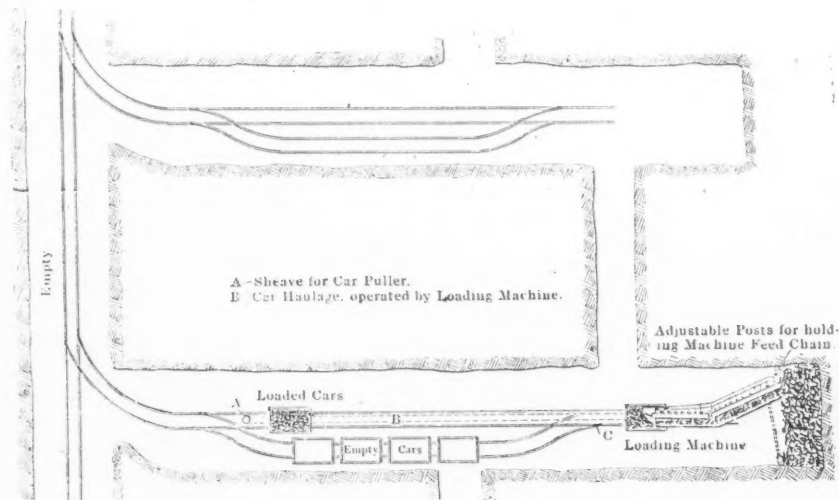


FIG. 2. METHOD OF LOADING ROOM COAL

To verify this statement, I give the following example:

In a 7-ft. seam, a 24-ft. room, where the coal is undercut by machines to a depth of 6 ft., will produce about 35 tons of coal for each cutting. This room can be undercut, the coal shot down, mine posts put up and track made ready for the loading machine in about two hours. The loading machine will move into this room and load out this amount of coal in two hours' time. The machine will then move to another room while No. 1 room is being undercut again the same day, so that 70 tons of coal are obtained from one room in one day. Fifteen such working rooms would give 1000 tons a day. If we add to this number as many more rooms for a surplus, we would still have only 30 rooms as against 150 rooms for the same output of coal by hand-loading. This, you will see, is only one-fifth of the number required for the same output of coal loaded by hand, and proves

as fast as a man ordinarily walks. In loading out a room, the machine will raise less dust than a hand-shoveler. The hand-loader in shoveling up a car of coal throws the coal from 6 to 10 ft., often throwing it twice from the corners and sides of the room. The dust arising from each shovelful as it falls is more than the machine makes in loading a car. With the machine, at no time does the coal fall more than 2 or 3 in. from the end of the delivery conveyer after the end of the car is once filled.

This is a point worthy of serious consideration at this time when the question of coal dust held in suspension in the mine air is of such great importance. And while referring to the question of safety in mines, it is well known that the use of machines has a marked tendency to raise the standard of intelligence among mine employees. Their work with the machine is neither heart-breaking nor back-breaking and their pay will be double their

present wage. They can be more safely trusted to work to the mine's advantage and to not ignorantly endanger their own and their fellow-workmen's lives.

In the machine mine, the track and timbering will be less in first cost, as the complete mine is one-third of the hand-loaded mine. The rooms can be quickly worked out and the ties, rail and timber be used over again. The undercutting machines will be benefited as the places to be cut will always be ready for them and will be confined to a much smaller territory.

BETTER ROOF RESULTS

The roof will be better as the machine loads out a room in such a short time that props can be set before the roof begins to work and fall. Under the present system, the props are set by the hand-loaders who defer the work as long as they can and take great chances. Statistics show that more men are killed by falls of slate than by mine explosions. The expense of cleaning up falls is always borne by the mineowner, and the fact that most of these falls occur over night shows that the matter of timbering is neglected by the miner, who wishes to finish loading out his place before doing his posting. With rooms cleared out in two hours' time and the timbering attended to by regular men, who would soon become experts, the falls referred to could be cut to a minimum.

The car-puller feature of the machine increases the efficiency of the present gathering locomotive fully 100 per cent. as the machine delivers 5 or 6 loaded cars to the room neck every hour, where now the gathering locomotive gets but one for which it must travel clear to the face.

In conclusion, I will state that this machine will work after any of the undercutters now in use, where the roof will permit the props to be set 8 ft. from the face; that the use of the machines will reduce the cost of producing a ton of coal $33 \frac{1}{3}$ per cent; that they will reduce the number of rooms necessary for a given output of coal 50 per cent.; that they will reduce the danger from mine explosions more than anything that has been suggested, and that they will have an elevating influence on the character of the miner, making his work simpler and easier to perform, appealing to his judgment and skill while increasing his earning power, and adding a fascination to the dull work of the mine that the sight of a shovel could never give.

While this article describes the use of the machine in coal mines, it can be used with equally good results in ore and metal mines and for the rapid driving of headings and railroad tunnels. The machine is made as low as 45 in., and for any gage of track.

The lead-ore production of Prussia in 1906 was 127,322 tons, 10,755 miners being employed.

The Prevention of Coal mine Explosions

BY W. B. WILLIAMS*

The unprecedented disastrous explosions in coal mines that have occurred during the past winter in various parts of our country, and which have resulted in the loss of over 1000 lives, have attracted the attention of the entire mining people of the United States; the many criticisms published in the newspapers throughout the country, will no doubt lead to legislation looking to the better protection of life and the safety of mining operations.

Having had considerable experience in mine explosions, I feel that possibly I may be able to say something in regard to this subject that may be of interest to mining men; and if the suggestions offered are followed, I feel sure that the dangerous elements that constitute the basis of explosions will be eliminated to a great extent.

OBSERVATIONS FROM ACTUAL EXPLOSIONS

During the past 14 years I have witnessed the effect of seven mine explosions in which 13 lives were lost; I assisted in the first examinations after the explosions, and in the recovery of the bodies in six of these cases. Two of these explosions occurred from gas combustion; the other five were from windy or blown-out shots and dust, in mines that were entirely free from explosive gases.

In the first mentioned explosions from gas, they occurred, as is usual in such cases, from carelessness on the part of the men working in a portion of the mine that gave off fire-damp, but did not create any disturbance in other parts of the workings, which was undoubtedly due to the fact that considerable moisture existed throughout the mines; in one instance from natural dampness, and in other cases from sprinkling.

The other five explosions, in the mines that were entirely free from gas, were caused by too rapid firing of shots, which generated a certain percentage of gas, mixing with the dust made by the shooting, together with an overheated atmosphere; this created a condition that only required a windy shot to result in a general explosion, causing the loss of life of the shot firers in every instance, and doing an enormous damage throughout the mines.

The most terrific explosions occurred in Mine No. 15 of the Rich Hill Coal Mining Company, of Rich Hill, Missouri, causing, in addition to the loss of life of the two shot firers, much damage to the general equipment. The force of this explosion is almost incredible; steel rails were twisted and bent as though passing through a furnace; mine cars were de-

molished into splinters; timbers were blown out a distance of a mile away from where the explosion originated, and the roof of the pit top was entirely blown away.

The investigation of this terrific explosion demonstrated the fact that the shot firers had disobeyed their instructions, and had fired some 87 shots in 13 min., which was entirely contrary to orders, and instead of traveling together according as required and together examining each shot carefully before firing, and deciding in their judgment whether it was safe or not, they had separated, and one was found three-quarters of a mile on the north side of the shaft, while the other body lay three-quarters of a mile on the south side. The amount of powder that was exploded in these shots was equal to 25 kegs of 25 lb. each. Notwithstanding the rules promulgated, which were considered, in the judgment of practical mining men, to make things as safe as possible, a number of explosions occurred in that field, and in every case resulted in the loss of life to the shot firers.

EXPLOSIONS DUE TO CARELESSNESS

The law of the State of Missouri calling for all men to be out of the mines when shooting takes place, except the shot firers, is a wise provision, and no doubt has resulted in a great saving of life. In each of the five explosions the direct cause was the ignition of dust by a windy shot, and subsequent examinations showed that they were due entirely to the carelessness of shot firers. There is no doubt, however, that if the mines in question had been well dampened by sprinkling, the danger would have been materially minimized; although where shots are fired by hand, there will always be the danger of the poorly prepared shot which, if fired, may result in causing a disastrous explosion.

To prevent such catastrophes, it will be necessary to remove the cause. The only remedy in the first instance will be proper ventilation; for this purpose I believe that the splitting of the air at each cross or room entry is the best system to follow, making crosscuts between entries and rooms as often as necessary to carry the air to the working faces at all times. Where it is sometimes inexpedient to make crosscuts as frequently as conditions call for, a good substantial brattice can be used with safety, if properly constructed and looked after, so that it will be air-tight at all times. I would also recommend that in mines generating explosive gases, safety lamps be used exclusively, as it will be found that gas explosions generally occur in workings where mixed lights are used.

A SYSTEM OF SPRINKLING

In reference to dusty mines, I strongly recommend the use of a first-class system of water lines, and that the mines be thor-

*General superintendent, Utah Fuel Company, Castle Gate, Utah.

oughly sprinkled up to the working faces of rooms and entries as often as is necessary to lay the dust that is made by mining; for this purpose I suggest that, if it is not feasible to use the underground pumps to supply the necessary water, a separate pumping system be established, and the water be pumped from the outside into the workings, forming an independent pipe line. For all ordinary-sized mines a 3-in. pipe line from the pump through all main entries will suffice, while 1½-in. pipe lines should be extended from the main line through all cross entries or levels, and ¾-in. pipes should be run from the cross-entry lines to the working rooms. One room pipe extending about 50 ft. from the cross entry is sufficient to water three rooms. Use ¾-in. hose about 200 ft. in length, which in most mines will be sufficiently long to reach the working faces.

FIRING BY ELECTRICITY

It is also advisable where electricity is used or is available, to have the shooting done by electricity after the men are all out of the mine; when this system is followed, there will be no losses of life in case of an explosion. In all of the mines of the Utah Fuel Company there is an elaborate system for sprinkling; in two of our camps we are shooting by the electric system, and soon expect to install the necessary equipment for firing all holes electrically after the men have left the mines. Even when these precautions are taken, it still requires constant vigilance and rigid discipline on the part of the mine management to compel the various employees to perform their duties properly, and the only danger that is liable to occur after the installation of such a system will be from neglect on the part of the employees in performing their duties.

Where the shooting is done by hand and shot firers are employed to fire the holes after the men have left the mine, there will always be more or less danger of explosions, from the fact that these men will, in many instances, fire poorly prepared shots that they know they should not. When the shots are fired at night after the men have left the mine (if this method is being followed), the speed of the fan should be reduced to at least one-third its normal speed, thereby decreasing the volume of the air current while shooting, as it is a well known fact that when explosions occur (especially dust explosions), they travel against the air current, and the greater the volume of air entering the mine the greater the damage will be.

Owing to the large percentage of incompetent foreigners now employed in this country, it is impossible to converse with these miners and instruct them in proper methods of mining; this makes it almost imperative that the companies employ shot inspectors and interpreters to instruct these people in the proper performance of their duties.

As a final suggestion, I would advise that only sufficient powder be allowed taken underground by each miner for the day's requirements, as powder has in the past cut a great figure in explosions by not being properly covered and cared for in boxes. In conclusion, it is not claimed that the precautionary measures here recommended will totally prevent explosions, but that an observance of the foregoing will materially reduce the dangers from such catastrophies.

Safety Sinking Hooks*

BY HENRY LOUIS

In shaft-sinking, it is the usual practice to work with two buckets, which are alternately attached to the winding-rope, so that one may be filled at the shaft-bottom, while the other is being emptied at the surface. The buckets are generally at-

ing hooks have been made and used and are found to answer perfectly, the object for which they were designed.

For many years, sliding ferrule sinking hooks have been satisfactorily used at the Baggeridge colliery, in South Staffordshire. Continual trouble, however, was experienced by the breakage of the ordinary spring, or by its losing temper and becoming weak; this fault was overcome by arranging the spring as shown in Fig. 2. The small projection *A* prevented the spring from being dashed against the back of the hook, but it did not remove the disadvantage caused by the loss of elasticity in the steel. In order to prevent any possibility of the bow of the bucket dropping off the hook, a machinist at the Baggeridge colliery, arranged for the hinge *B*, of the spring-portion to be welded to the top, as shown in Fig. 3, leaving a sufficient space *C*, between the point of the hook and the slide-piece *D*, for the bow to pass

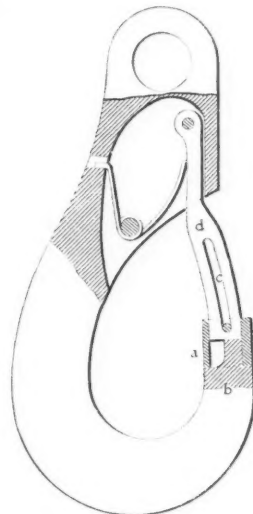


FIG. 1. - Safety Hook. Scale, 4 Inches to 1 Inch

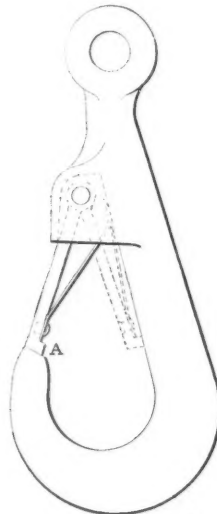


FIG. 2. - Spring Hook. Scale, 6 Inches to 1 Inch.

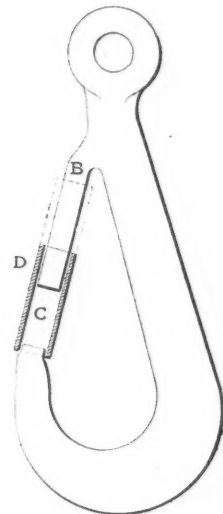


FIG. 3. - Safety Hook. Scale, 6 Inches to 1 Inch.

tached to the rope by means of an ordinary spring hook; it may occasionally happen that a bucket will drop off the hook, through the spring being weak or because the bucket is improperly loaded and attached. It was through an accident of this kind that I was prompted to devise the hook illustrated in Fig. 1.

A sliding ferrule, *a*, fitted to the tongue of the hook, is prevented from dropping off it by a pin passing through a slot *c* in the tongue *d*. To open the hook, the ferrule is simply pushed upward as far as it will go, and when the hook is closed, the ferrule slides down over the point *b*, thus firmly locking the hook, which cannot be opened without sliding the ferrule up. The safety of the hook is thus independent of the spring, which may, indeed, be dispensed with if desired, although I prefer to retain it. Several of these lock-

through; this was sealed during all ordinary operations by the sliding ferrule *D* which always dropped unless it was deliberately propped up. Experience proved that the hook was more safe, when the spring was entirely dispensed with.

Selecting One of Two Shafts for Hoisting

In gaseous mines where either the up-cast or the down-cast are available for hoisting, experience has shown that it is better to use the lower opening for hoisting and locate the exhaust fan at the higher opening. The ventilator should be placed somewhat back from the shaft mouth and should be protected by doors situated in the air conduit over the shaft. This arrangement makes the ventilation ascensional and during winter assists the fan by the natural air column. It also shortens the depth of the hoist.

*Abstract of paper read before the North of England Institute of Mining and Mechanical Engineers.

Colliery Notes, Observations and Comments

Practical Hints Gathered from Experience and from the Study of Problems Peculiar to Bituminous and Anthracite Coal Mining

DEVELOPMENT AND MANAGEMENT

In case of a fire in a mine, extinguish the burning timber and coal before attending to the burning feeder, for while a feeder is burning, firedamp is less apt to accumulate. Water thrown at frequent intervals against the top of a burning chamber will help to prevent an accumulation of gas.

Electric cables in mines should have a suitable conductivity and be armored with an effective insulating material. It is safer to have them conveyed along the main intake airways only. Cables suspended from props cannot be regarded as safe from roof falls, and consequently, it is better to lay them in trenches.

The Bering river coalfield of Alaska is about 85 square miles in area. Its principal seam is 20 ft. thick and is of a semi-anthracite character. There are other seams which contain less fixed carbon and are bituminous in character. A fairly pure natural coke of high heating power is also found in this region.

When about to purchase a hoisting engine, bear in mind the following points: The length of the haul or the depth of the shaft; the amount the engine will be called upon to hoist per trip and per day, and the kind of cage to be used. If coal is the material to be hoisted, remember that experience has shown that for this kind of work, the slide, valve, simply constructed, plain balanced engine, placed on heavy bed frames gives excellent results, and with care will last practically a life time.

A first-class coal-cutting machine should be of simple and strong construction; it should be capable of adjustment while in motion and should be so built that it can cut from left to right and *vice versa*; to give regularity of cut and to equalize the strain, the edges should be equidistant from the center, it should be capable of holing to a depth of 5, 6 or 7 ft. so as to obviate the necessity of using explosives; it should make a cut high enough to cause a complete break between the solid and the excavated coal.

An effective method of preventing the freezing of cylinders and the exhaust of a compressed-air hoisting engine, is to allow the weight of a descending cage to reverse the drum and drive the engine backward and thus draw air into the exhaust which will be compressed in the pipe and stop the lowering of the temperature and the formation of frost in the cylinder. If the engine used cannot be

reversed, or if it is not possible to reheat the air, the same effect may be produced by arranging a small jet of water in such a manner that it will play into the exhaust opening.

The Vesta No. 4 coal mine at California, Penn., is in some respects the most remarkable coal mine in the world. During the first month of its operation 1400 miners produced 174,338 tons of coal, an average of 124½ tons per miner per month; the largest output for any one day was 7225 tons. The property consists of 20,000 acres through which runs a 6-ft. seam of coal. There are 600 rooms in the mine; 85 miles of stationary railway track and 24 miles of movable track; 28 electric locomotives are used to haul the trains of 3-ton steel mine cars; main haulage roads are equipped with 90-lb. rails. It is estimated that there is coal enough in sight to keep the mine working for 60 years.

In shafts which have three landings, a distinct system of signal bells should be maintained. Each landing should have a bell that can be readily recognized as belonging to that level and no other. The cage should never be moved from a landing until the engineer has received and answered the signal. As an additional precaution, a signalman should be stationed at each landing to give all cage signals. The wires for such a system should be protected so that they cannot be injured by movements of the cage or by the men. Care should be taken by the signalman to see that the keeps at a landing do not protrude into the shaft and hinder the cage in its descent. Safety gates and wings should be locked when work is abandoned at any landing.

In 1906 the quantity of machine-mined bituminous coal produced in the United States was 15,451,075 short tons greater than in 1905, while the total production of bituminous coal increased 21,534,643 tons, which shows that over 72 per cent. of the production increase in 1906 over 1905 was in the machine mined coal. The average output for each machine increased from 10,258 tons in 1904 to 11,258 tons in 1905 and 11,683 tons in 1906. Of the 10,212 machines used in 1906, 5911 or 58 per cent. were of the pick or puncher type; 4144 or 40.5 per cent. were chain breast machines and 157 or 1.5 per cent. were longwall. In the number of machines used, Pennsylvania led in 1906, while Ohio stood first in the percentage of machine-mined coal to the total product.

The three kinds of pipe joints most effective in preventing leaks are the bell and spigot, the bell and plain end and the turned spigot and bored bell. The bell and spigot is the most flexible and gives excellent results under high pressure, for its flexibility allows it to expand and contract without effecting the tightness. Some prefer the bell and plain-end joint as the plain end is more easily centered in the bottom of the bell. The turned spigot and bored-bell joint is a metal joint and cannot leak unless broken. Bolted joints with or without flanges should not be used underground because the bolts are apt to rust and the joint is too rigid. An iron-to-iron joint is subject to rust besides being inflexible. If iron joints must be used they should be of the turned and bored variety without bolts.

The coal mines of the Miike coalfield in Japan are the largest in that country, producing on an average 4000 tons of coal in a working day of 24 hours. The area being developed is about 300 acres, while the thickness of the two seams worked varies from 5 to 25 ft. The coal obtained is a coking bituminous, and is excellent for boiler use. The amount of coke produced per ton of coal is about 58 per cent., while the tar obtained averages about 10 per cent. and is of excellent quality. The coal is obtained by the room-and-pillar system, and about 30 per cent. of the bed is extracted. The cutting is mostly done by hand, a miner averaging about 2½ tons per day. The chief obstacle to be overcome in these mines is water; for every ton of coal mined, 12 tons of water are pumped from the workings.

Liquid air is used to some extent for blasting purposes in a few German coal mines. It was first used in combination with other materials, but is now used alone. Its explosive power depends upon its property of turning suddenly into vapor at an elevated temperature. If the vessel holding the liquid air is sufficiently tight, a high explosive power is attained. For this reason vessels with a small opening are used for storing it. This characteristic makes it necessary to place the cartridge in place before it is loaded. The cartridges are made of thick phosphor bronze and are loaded so that the pressure reaches 80 lb. per sq.in. The explosion takes place in 6 or 8 min. after loading. About 30 tons of coal are broken by one shot. The coal falls in blocks about 2 ft. in circumference. A heavier loading of the cartridge would cause the coal to be broken into slack.

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Our Coal Mines from a French Standpoint

After the terrific explosion at the Courrières mine in France, on March 11, 1906, the engineers and coal operators of that country became thoroughly alarmed respecting the danger attending coal mining, and important steps were taken immediately to study, and if possible prevent further accidents of this kind. An experimental station for the study of coal dust and mine gases was established at an advantageous point adjacent to the more important mines.

When the news of the loss of nearly 400 lives in the disastrous explosion at the Monongah mines near Fairmont, W. Va., was heard in France, M. Taffanel, the directing engineer of the experimental station was at once sent to investigate. He has lately made a report, which is not complimentary to mining conditions existing here. In speaking of the Monongah explosion, he condemns the use of naked lights in the mines, where gas was present, and decries the freedom allowed miners in handling and carrying of powder underground. He states, moreover, that much dust was present in the workings and that no efficient method of sprinkling was used. He puts emphasis upon the absence of the most elementary apparatus for life saving, which is obligatory in Europe, but is quite unknown in West Virginia. Unfortunately we are obliged to admit the truth of these criticisms.

Of particular interest are M. Taffanel's opinions respecting the cause of the Monongah explosion. He criticizes the conclusions of the majority of the American engineers who located the origin of the first explosion in the farthest and deepest part of the mine. M. Taffanel became convinced that the center of the explosion was at the foot of the No. 6 slope where a train of loaded cars had been wrecked, after breaking loose and dashing down the slope. As to whether this caused a short circuit between the trolley wires and the rails, or whether the exposed flame of a miner's lamp set fire to the coal dust which was raised, he does not say. This is quite different from the verdict of the coroner's jury, which it will be remembered we treated rather lightly at the time it was made. Our own opinion, based on investigations in the mine, immediately after the explosion, was that

the run-away trip was the cause. It is important to note that M. Taffanel confirms that opinion.

The Yukon Gold Company

The sale of the Treasury stock of the Yukon Gold Company has thrown a chill upon financial and speculative circles. There is considerable doubt as to whether the 700,000 shares were wholly sold, but whatever is the inwardness of the business, it has come in for general condemnation. This is directed toward the Guggenheims and Thomas W. Lawson. The flamboyant, delusive advertisements of Mr. Lawson are deprecated, but such things are expected of him. The amazing thing is that the Guggenheims should have appeared in this association with him. But after all the chief reason for the depression over the affair is the feeling that an attempt has been made to dispose of unproved property at a good deal more than its actual value.

This, if true, is the real ground for condemnation, and not the antics of Mr. Lawson, who acted as salesman and naturally displayed his goods in the best possible manner. Criticisms may be more properly directed against the engineers, who failed in their reports to call attention to serious difficulties which have already been experienced in working the Yukon placers, and avoided any particular reference to the time required for extracting their gold, although as we pointed out, a fortnight ago, that is a factor of supreme importance in determining the value of the property, which of course, was well known to the vendors and the engineers. It has been suggested that these matters were discussed in portions of the engineers' reports that were omitted, but that is improbable, because no engineer who values his reputation would permit such a misuse of his report and be silent about it.

We have been asked by a correspondent to figure what would be the net yield of gross proceeds of \$10 per share of Yukon stock if spread equally over the period of 20 years, computed in the same way as in the editorial in our issue of April 4. A total of \$10 per share in 20 years, or 50c. per annum, would produce about 35c., or 7 per cent. on \$5, reckoning amortization at 5 per cent. In order to secure a return of 8 per cent. the stock would have to be bought at \$43 1/4; of 10 per cent., at \$3.50.

A matter in connection with the Yukon Gold Company which requires some explanation is the amount of its capital stock. Thomas W. Lawson stated in his advertisement of March 27 that the capital is \$17,500,000, divided into 3,500,000 shares, of \$5 each. In his exhibit *D* he gives "Capital outstanding, \$17,500,000; 3,500,000 shares; par \$5." The certificates of the Yukon Gold Company state the capital as \$25,000,000, divided into 5,000,000 shares of \$5 each. Apparently, therefore, the company is authorized to issue stock to the amount of \$7,500,000 in addition to that which is now outstanding.

The Projected Copper Consolidation

In spite of the Yukon fiasco, the term is appropriate inasmuch as the shares which were sold at \$6 and higher have fallen to \$4.50, the plans for the flotation of the Utah and Nevada copper mines consolidation are said to be going steadily ahead. The Consolidated Copper Company, organized last year, with a capital stock of \$50,000,000, has been reorganized as the Coppermines Company, with a capital stock of \$60,000,000. This company is designed to take over the Utah Copper Company, the Nevada Consolidated Copper Company and the Cumberland-Ely Copper Company. If this plan be consummated, the new company will control a copper production of about 114,000,000 lb. per annum in the near future, and it will be the cheapest large supply of copper in North America.

However, it is not easy to see what advantage the three companies will derive, inasmuch as each one is a thoroughly self-contained unit. Evidently the promoters have in mind the organization of another Amalgamated, which will afford great opportunities in the stock market.

It has not yet been announced on what basis the three companies are to be taken over, but rumor says \$30 per share for Utah, \$12.50 for Nevada and \$7.50 for Cumberland-Ely. It will be sufficient time to discuss the valuations when the respective figures have been formally announced. The minority owners of the Utah Copper Company and Nevada Consolidated have great confidence in the value of their property, and being thoroughly informed respecting the physical conditions, may be relied upon to obtain their due, whatever may be the special wishes of the owners of the majority interests.

The New Mining Society

A meeting of the Council of the American Institute of Mining Engineers and some of the leading mining engineers of New York was held last week, at the rooms of the Institute, to consider the effect of the organization of the new mining society. The executive committee of the latter was present at the meeting and explained its purposes. The latter received considerable discussion, as did also the probable effect of the new society upon the Institute. It was suggested that membership in the new society be confined to the membership of the Institute, but it proved to be the sense of the meeting that this should not be asked.

The meeting served two good purposes, inasmuch as it enabled the executive committee of the new society to explain its purposes more fully than could well be done by correspondence; while, moreover, it put the new society in the position of having approached the council of the American Institute of Mining Engineers with a spirit of making concessions that would protect the latter. Although there seemed to be no satisfactory concession which could be made, except the abandonment or deferment of the new society, neither of which concessions was considered to be easily practicable (the organization of the new society having previously been specifically determined upon), the new society occupies a better position from having conferred with the officers of the Institute than if it had gone ahead without any discussion of the plans with them. The formal organization of the new society is to be effected April 20 at a meeting to be held at the Engineers' Club, New York.

The Situation in Copper

After having displayed a decidedly upward tendency, the market became weak on March 30 upon news from China that the mints in that country had been closed to the coinage of copper, which was accompanied by an attempt on the part of Chinese brokers to dispose of supplies that they had previously contracted. These supplies were partly afloat and partly in New York, not yet shipped. The demand for consumption, both at home and abroad, having slackened materially during the week immediately preceding, the effort to sell copper from China at once had a

depressing effect upon the market. Some cancellations of orders were secured, of course, for a consideration, and some offerings were made at rather low prices and a few transactions were effected. However, this condition can be of only temporary effect, inasmuch as the quantity of copper sold to China, late in 1907 and early in 1908, was not very large. The future of the market depends still, as heretofore, largely upon the status of the domestic manufacturing business and the effect of the new supplies of copper which are rapidly beginning to materialize.

IN THIS ISSUE commences a series of articles by J. R. Finlay upon the cost of mining, in which the actual cost of production in many important mining districts of the United States is carefully analyzed. In some cases the results will be found to be surprising when compared with the ideas commonly held. It is becoming well recognized that the report of a mining company for any single year does not give an accurate idea of its status, but in combining the figures for a series of years the actual condition of affairs develops. Mr. Finlay has made a long study of the economics of mining in the broadest sense, and his conclusions will be found to be of great value. The first article is of an introductory character. In subsequent articles he will take up the cost of production in many of the important mining districts and will discuss the conditions governing operations.

THE COMMUNICATION RESPECTING the zinc-ore question, published elsewhere in this issue, is particularly interesting, inasmuch as it renews attention to an injustice, which ought easily to be capable of correction. Irrespective of the legal merits of this case, it is certainly unfair that the whole industry should have to remain in such a condition of uncertainty. The case was argued before the court fully a year ago, and as far back as last May a decision was expected any day. However, the judge before whom the case had been argued, became sick and had to go to Europe. Upon his return, his house burned, destroying the papers in the case and causing delay for the preparation of other copies. Nevertheless, in spite of these accidents, it seems as if a decision should have been rendered long before this, and it is to be hoped that something can be done to hasten it.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice or Suggested by Articles in the Journal, and Inquiries for Information

CORRESPONDENCE AND DISCUSSION

The Yukon Gold Company

"Fair Finance" of the "Yukon Gold" is at present receiving so much notice in the newspapers by reason of the respectable and reputable names connected with it that I have been tempted to analyze some of Mr. Lawson's figures and compare the results with reliable data obtained in Alaska and Siberia by mining engineers known for their skill and trustworthiness. I give the conclusions below without comment, save to say that judging from my own experience, I believe them correct.

The amount of gold-bearing Klondike gravel given by Mr. Treadgold, as contained in this property, is 137,000,000 cu. yd., which it is estimated will yield a gross return of \$58,540,000 and a net of \$43,950,000. This means that as a general average every cubic yard of this gravel will give a gross yield of 42.7c. of gold, and a net of 32c. The cost of extraction is 10.7c., say 10c. per cubic yard.

Mr. Lawson states that "Yukon Gold is a dredging and hydraulic, instead of a deep mining proposition." The experience of gold dredging in Alaska has been to the effect that it costs 80c. per cu.yd. in the Yukon district when the ground has to be thawed, and not less than 30c. in the Seward peninsula under more favorable conditions. C. W. Purington, in his excellent report on "Gravel and Placer Mining in Alaska" (Bulletin No. 263, U. S. Geological Survey) instances 17 different systems of operating and gives data obtained from 98 different operations in Alaska. Selecting the systems that have given the *lowest cost* we find that 13 hydraulic operations in the interior of Alaska (no pumping of water) cost upon an average 23.8c. per cu.yd., say 24c. The average for "ground sluicing" after stripping the overburden is 17c. and 10c. for interior Alaska and Seward peninsula respectively. For dredging he gives 49c. per cu.yd. in the interior, and 43c. per cu.yd. for Seward peninsula. In this connection he states (p. 36) that "in the interior only bench gravels are hydraulicked and it should be distinctly understood, if the hydraulic costs in the interior appear attractively low, that the water supply is exceedingly variable and that no reliable estimate can be made beforehand of the output of the season's operations. Furthermore, while much of the bench gravel was originally rich, the pay streaks have been largely drifted out,

and the gold is not disseminated through the upper portion of the gravel to the extent that it is in the California gravel banks. With regard to the pumping of water for hydraulic purposes, the practice cannot be too strongly condemned. He is a bold man who attempts it, and a singularly fortunate one who makes a financial success of it."

If we now take Mr. Purington's figures for hydraulic mining and dredging, and compute an average, we have thus 49c. per cu.yd. for dredging, 24c. for hydraulic and 17c. for ground sluicing, the arithmetical mean being 30 cents.

Therefore, accepting Mr. Treadgold's figures of an average gross value per yard of 42c., we have a net of 12c. per cu.yd. Assuming that 2,000,000 cu.yd. of gravel can be washed each year, by the three systems mentioned above, which is an improbable result, since the duration of the operating season is but three months, we have a net annual gain of \$240,000. The capital of this concern is given as \$17,500,000, hence such a profit would represent an annual return of less than 1.5 per cent. upon the investment, making no allowance whatever for depreciation, accidents and other contingencies.

Turning now to Siberia, where similar conditions obtain in many places, some interesting data may be derived from Levat's "*L'Or en Sibirie Orientale*," published in Paris, 1897; "*Les Gisements Auriferes de Sibirie*," by Baron Renè de Batz, Paris, 1898; Loranski's "Statistics of the Mining Industry of Russia," published in St. Petersburg, 1899.

The tenor of the gold-bearing gravels that are considered workable in the Urals, averages 95c. per cu.yd.; in western Siberia, 90c., and in eastern Siberia, \$1.75 per cu.yd. In eastern Siberia the ground is generally frozen throughout the year, and the overburden varies from 6 in. to 60 ft. in thickness. When thin, it is stripped off by hand, in winter, when labor is cheapest, but when thick the gold-bearing gravel is drifted upon, which even with the cheap labor of the country is relatively expensive.

Stephen Birch in an estimate quoted by Purington (p. 39), states that in the Nizina district, Alaska, ground sluicing through a 20-in. flume cost 43c. per cu.yd. Hydraulic with an 8-in. nozzle through 20-in. flume cost 91c. per cubic yard.

It would seem, therefore from the above figures that the promoters are basing

their estimates upon an enormous mass of relatively low-grade gravels which have been more or less exhausted by the workings of former days, or else were never rich enough to have been operated by pick and shovel methods. Obviously 42c. ground cannot be worked by dredge profitably, even if not frozen, which must be very seldom. Hydraulic and sluicing would pay under such conditions, provided there be plenty of water and pressure with other favorable conditions. Taking the lowest figure (17c. per cu.yd.) for sluicing, we should have a profit of 25c. per cu.yd., and supposing 1,000,000 cu.yd. could be so treated each year, which is perhaps improbable, we would have a profit of \$250,000, representing an annual return upon the capitalization of about 1½ per cent. Similarly, assuming that 1,000,000 cu.yd. per year could be hydraulicked at a cost of 24c., we should have a profit of 18c. per cu.yd., or \$180,000, or about 1 per cent. upon the capital. In other words, omitting dredging as out of the question with 42c. gravel and supposing 1,000,000 cu.yd. would be treated by each of these methods, we have a net annual return upon the capitalization of only 2½ per cent. Two conclusions regarding this scheme are, therefore, unavoidable. First, it is hopelessly over-capitalized, and would be a financial failure even at the moderate cost figures that I have given, and secondly, the inferential cost of extraction, viz., 10c. per cu.yd., is ridiculously low and cannot be substantiated by reliable data from disinterested sources.

F. LYNWOOD GARRISON.

Philadelphia, April 7, 1908.

The Neill Process at Coconino

The JOURNAL of March 14 contains an article by James W. Neill, entitled, "The Neill Process at Coconino, Arizona," in which he criticized my article on the same subject which appeared in the JOURNAL of Jan. 18. Since I was largely responsible for the introduction of the process to the owners of the Coconino, I should like to correct a few errors that appear in Mr. Neill's article.

My report made to P. L. Kimberly, of Chicago, was that large horizontal beds of ore containing 7 per cent. copper occur on the Kaibab plateau, but that the lack of fuel and flux rendered them valueless. Learning later of Mr. Neill's process, I had several hundred pounds of the ore

sent to him for testing in a small plant capable of treating 50 lb. of material. The plant, as I remember, consisted of an oil barrel set upright, fitted with an inlet tube reaching nearly to the bottom of the barrel and connected with a closed sulphur burner; the pressure required for forcing the air into the burner and the resulting products of combustion through the barrel was supplied by a small compressor driven by an electric motor. The barrel may have contained contrivances for breaking up the gas bubbles and agitating the ore, but I never saw the inside, and my recollection is that the gas current did all the agitation that was required.

HISTORY OF THE COCONINO PLANT

These laboratory results were satisfactory and I advised Mr. Kimberly, who had acquired an interest in the property, to arrange with Mr. Neill for the use of his process, and advocated, together with Mr. Neill, the building of a small plant at Salt Lake City. We were overruled and Mr. Neill was requested to furnish plans for a 30-ton plant to be erected at Coconino. The plans were submitted to several machinery houses, including Fraser & Chalmers. This firm suggested the use of rubber hose and lead pipe for the more expensive copper pipe required by the original Neill plans. These were the principal changes made and did not affect the general design in the least.

My name was placed on these plans without my consent by the Fraser & Chalmers draftsman at the request of H. M. Ryan, the heaviest owner in Coconino. Setting aside the question of whose name appeared on the blueprints, the process has always been known as the Neill process, and has been so reported in Stevens' "Copper Handbook" and the current technical literature of that time.

The plant was furnished by Fraser & Chalmers and erected by Joseph Diedrich; a Salt Lake City mill builder. I never saw the plant until it was finished and turned over to me to experiment with. The results of these experiments have already been described in the JOURNAL.

I did not know at that time of the Butte experiments Mr. Neill refers to, and am still in ignorance of the reason why he substituted the untried stationary tanks in the Coconino plans for the revolving barrels which were so successful at Butte. The story of Coconino might have been different if these had been used.

INSUFFICIENT CONTACT WITH GAS

The agitation of the ore and water, which is essential, was obtained in the Coconino plant by the current of gas passing through the solution, but this was not sufficient as the ore formed compact layers on the cones that formed the bottom of the tanks, rendering the leaching a very slow process. The low copper content of the solutions was due to the small excess

of sulphur dioxide that we could get into the solution. In later experiments with a revolving barrel I have had as high as 2 per cent. copper in the solutions.

If the solution is deficient in free sulphur dioxide, copper will invariably separate as cupro-cupric sulphite on exposure to the air. The cakes from our filter press always contained copper in this form that could not be dissolved by washing with sulphur dioxide water.

Scrap iron could not be had at a reasonable cost at Coconino, and lime was substituted as a precipitant, but the product was low in copper and hard to treat. No copper was ever made commercially; consequently, no royalty was ever due Mr. Neill. The failure of the plant was a far more serious matter to the owners and myself than it was to Mr. Neill, and we certainly tried everything that suggested itself to make the Neill process and Coconino a success.

The chemistry of the process is satisfactory, for all the oxidized ores of copper, with the exception of cuprite, are easily soluble in sulphurous acid, and the copper is readily recovered from these solutions. The difficulties have been in the application of the chemical reactions on a large scale. I trust that Mr. Neill will overcome these difficulties and place his theoretically correct process on a commercial basis.

E. P. JENNINGS.

Salt Lake City, March 24, 1908.

[This discussion is now closed.—EDITOR.]

The Zinc Ore Question

The following is the substance of a letter addressed by us to the Secretary of the Treasury under this date:

Zinc ore and all other materials imported through the custom houses are valued on a grab sample, which necessarily is inaccurate, and duty is assessed on the basis of the assays made from these grab samples. In cases of protest the board of appraisers has frequently disregarded the careful sampling at the point of destination made jointly by buyers and sellers on the ground that this sampling was done in the absence of a representative of the Custom House, and therefore would not be accepted as official. Protests have been lodged, and frequently over-ruled, not only for importation of zinc ore, but also for the importation of metals and minerals in New York custom district.

If it could be arranged that the Custom House appoint a representative to be present at the sampling of the goods at buyer's works, in the presence of seller's representative, much trouble could be avoided, and duties would be assessed strictly in accordance with the contents of the ore or metal.

We further beg to call attention to the fact that a decision in the case before

the United States Circuit Court for southern Texas regarding the duty on zinc ore has not yet been rendered, although testimony was heard over a year ago. This matter is of great importance to the industry, and we beg to suggest that the treasury department, if possible, request the Attorney General of the United States to inquire whether a speedy verdict cannot be rendered, the question being of such vital importance to a large industry.

We urge further that in case the decision of the United States Circuit Court for southern Texas be against the Government, and in favor of the importer, the treasury department refrain from another appeal in order not to disturb further an industry which is suffering severely from the results of the recent panic, and which depends materially upon importations of ore from foreign countries.

The importation of zinc ore in 1906 was 87,102 tons; the total production of zinc ore in this country was 471,698 tons; and the total production of spelter was 224,770 tons.

Assuming an average content of 50 per cent. zinc in the ore produced in this country, it will be apparent that the production of ore in this country is insufficient to supply the domestic consumption of spelter (about 85 per cent. of the zinc content of an ore is recoverable as spelter). According to the ENGINEERING AND MINING JOURNAL, the consumption of spelter in 1907 was 222,765 tons, while the production was 250,000 tons. It is self evident, therefore, that the American spelter production depends upon the importation of ore from foreign countries.

The zinc industry of this country at the present time is in great distress; production has fallen off 45 per cent., but the consumption has surely fallen off over 60 per cent. Enormous stocks of spelter have accumulated in the hands of producers, which cannot be sold except at a heavy sacrifice. From 50 to 75 per cent. of the zinc smelters in this country are doing business at a loss, preferring to run their smelters on a reduced tonnage rather than disband a valuable organization.

The industry certainly deserves a chance to settle upon a peaceful basis, and to know from where it may draw its supply of ore, and whether ore coming from foreign countries is dutiable or not. We hope that the department will see its way to abide by the decision of the Texas court, in case it should be against the Government.

The collectors of the ports are insisting that the manifests be made valuing a metric ton containing 40 per cent. zinc at \$16, with a variation of \$1 per unit up or down. On this basis they collect 20 per cent. ad valorem duty. This arbitrary valuation is unjust, and works a great hardship upon the shipper. We are buying ores in Mexico now at a price which makes them worth at the border \$10 per

ton, with zinc contents of 40 per cent. The value of these ores varies according to the market price of spelter, and it is unfair that we should now pay duty upon a material which has decreased in price at the same rate as during prosperous times.

If foreign ores are kept out of this country by a high duty, they will go to European smelters in spite of the geographic advantage which we have. It has been suggested that it would be feasible to smelt imported ore in bond, and ship the product to foreign countries. A careful study of the situation shows that this is impossible, the freight rate from Mexican ports to European being no higher than from Mexican ports to American zinc smelters. In reshipping the manufactured product, the American smelters would be at a disadvantage by the amount of freight on the product from their smelters to the European places of consumption.

L. VOGELSTEIN & Co.

New York, March 31, 1908.

Working Costs at Rand Mines

Referring to the articles by George A. Denny recently published in the JOURNAL, I regret that enough official figures are not available to warrant a full analysis of all the points raised. But a copy of the report of the Robinson Deep among my papers fortunately happens to be the annual statement for the fiscal year 1906, which it seems is the year Mr. Denny refers to. Mr. Denny claims that the published costs are fictitious and do not include enormous sums that should be made to appear in the costs. It is not clear how he obtains the figures he gives as costs per ton milled, for they are quite different from those given in the annual report of the company for 1906. A comparison of Mr. Denny's figures with those of the official report is as follows:

COMPARISON OF OFFICIAL FIGURES OF ROBINSON DEEP MINE FOR 1906 WITH THOSE USED BY MR. DENNY

DENNY'S FIGURES.		OFFICIAL REPORT.	
Mining expenses	14.7s	Milling	2s 9.991d
Reduction expenses	5.6	Cyaniding	1 7.471
General expenses	1.1	Slimes	0 7.129
Equipment expenses	7.3		7 316
Shafts and development	2.7		4.574
Property purchase	4.5		3.527
Sorting and crushing			3.275
Ore transportation			1.957
Mine office charges			2 10.545
London-Paris office			21 10.739
Development redemption			
Total	35.9		

It will be noted that the official figures contain five items amounting to 3s. 11.878d. not charged in Mr. Denny's figures, the largest of which is for development redemption; while only three headings appear in his statement that do not appear in the official statement of costs, and these three items, being purely capital expenditure, are treated by the company as such. As to these, the total capital expenditure for equipment is offici-

ally given as £749,476; for shafts and development, £327,665; for property, £560,394; total, £1,077,341.

ESTIMATES OF ORE IN MINES

It is very difficult, even in orebodies as constant as those on the Rand, accurately to predetermine the ore contents of a property; and the ore content of such mines as have already been worked out on the Rand has proved in every case to have been very greatly underestimated, the most extravagant estimates having fallen far short of the ore actually produced. In 1905 it was officially announced that up to that date the Robinson Deep mine had actually yielded 64,000 tons per claim worked, and that faults and dikes represented but 12.5 per cent. of the area mined. Mabson figures that on March 31, 1906, there remained 10,525,000 tons, which would supply 500,000 tons a year for 21 years. On this basis an annuity of 3 per cent. to redeem in 20 years the total expenditure for property, shafts and development and equipment (which appear to be what Mr. Denny terms "non-included costs") would require an item of 2s. 4.23d. to be charged against each ton worked; and inasmuch as the official costs already contain an item of 2s. 10.545d. for development redemption, there seems to be no occasion for solicitude in regard to the "non-included costs."

THE CHARGE OF INCOMPLETE REPORTS

To those who have any accurate knowledge of the matter, the insinuation that the "group" controlling the Robinson Deep have published false or doctored statements requires no refutation. But with others, the arrangement of alleged facts and imaginary figures might have some weight, and to such I may say that after a connection with the group extending over 10 years in a capacity affording every opportunity for an intimate knowledge of the matter, I am free to say that

make them, and the Consolidated Gold Fields of S. A., Ltd., is as straight and honest as any corporation in any country.

It is the fashion just now to rail at the Rand, and to say all manner of evil against it, and while there have been plenty of mistakes there as elsewhere, so far as the operations of the reputable houses are concerned, the mistakes have been honestly made. But neither the mistakes of its friends nor the misrepresentations of its foes can alter the fact that the gold is there and is being won each year more and more economically by the honest efforts of capable men.

R. M. CATLIN.

Franklin Furnace, N. J., April 7, 1908.

French Slates in Cornwall

I note in a recent issue of the JOURNAL in an article dealing with the causes of the decline of the slate trade in Great Britain, a paragraph to the following effect:

"These French slates are of good quality and low in price. As an example of their popularity I may mention that a church in North Cornwall has recently been roofed with them in spite of the fact that the celebrated Delabole quarries are only two miles away."

This statement is absolutely incorrect, and I request that it be corrected. In fact not only is it not the case as stated, but in many instances where foreign slates have been used, they have in a few years after having been put on the roof, had to be removed and Delabole slates substituted.

F. L. HAUGHTON.

Delabole, Cornwall, Feb. 28, 1908.

We believe the author of the article was in error in saying that the church was only two miles away. That foreign slates have been used in Cornwall and Devon is a matter of common knowledge. The instance quoted by Mr. Haughton occurred at Okehampton, a town in Devonshire not far from Delabole, so that the presence of foreign slates within his sphere of influence is admitted by him. However, this is not the point. What the author of the article intended to convey was the fact that during the period of high prices in Great Britain, foreign slate producers got a foothold in the country. A statement of that fact was not intended as a reflection on the quality of Delabole slate or the business capacity of the officers of the company.

The Lluvia de Oro district in Mexico is one of the few gold camps discovered in Mexico in recent years. The existence of the gold ore in this district was known to the Indians but they concealed the veins so well that it was not until 1900 that white men discovered the ore.

The Fluss-schacht mine at Ufrungen, Prussia, produced 15,834 tons of fluor-spar in 1906.

in all those years, some of which were years of war and stress, never did I observe the slightest tendency to vary any fact or figures from the actual truth.

Though for more than two years the members of the group have passed entirely out of my knowledge, there is no reason to suppose they have changed their customs, and I have no hesitation in saying that whatever reports they publish are as near the truth as they know how to

New Publications

METALLURGY OF TIN. P. J. Thibault, Pp. 254; illustrated, 5½x9 in.; cloth, 12s. 6d. Sydney and Melbourne, 1908: *Australian Mining Standard*.

This book undertakes to treat the metallurgy of tin in its broadest sense, covering the distribution of tin ores, the methods of mining, assaying, dressing, and finally smelting. We do not think that it adds anything material to the literature of the subject. It is distinctly inferior to what is now demanded and expected of metallurgical treatises. Probably there is something good in it, but if so it is buried in a hopeless way. Seldom do we see a book of such forbidding appearance as this one has. The typography, make-up, illustrations, paper and printing are equally execrable.

PRACTICAL METHODS FOR THE IRON- AND STEEL-WORKS CHEMIST—By J. K. Heess. Pp. 60; 6x9¼ in.; cloth, \$1.25. Easton, Penn., 1908: Chemical Publishing Company.

In this work the methods of analyses of materials, encountered in the daily routine of the iron- or steel-works chemist, are given as briefly as possible. The reader is not presented with a variety of different methods for the same analysis, from which he must make his own choice, but that method which has been found to be satisfactory in practice is given, step by step, in simple language. While this necessarily narrows the scope of the book, there are many points to commend it to busy chemists and especially to those who have not had special training in this particular line.

MINE GASES AND EXPLOSIONS. Text Book for Schools and Colleges and for General Reference. By J. T. Beard. Pp. 402; illustrated. 5¼x8¼ in.; cloth, \$3. New York, 1908: John Wiley & Sons. London: Chapman & Hall, Ltd.

Contents—The chemistry and physics of gases. Heat and its effects. The atmosphere. The common mine gases. Mine explosions. Safety lamps. Testing for gas. Addenda.

The book is Mr. Beard's most interesting and valuable contribution to the subject of mine ventilation, and will undoubtedly secure the attention of those interested in coal mining. The work being generally free from highly technical discussion is comprehensible by the average mining man, while at the same time, the subject is treated in sufficient detail to make it useful as a text book in schools and colleges. The author gives the name "flashdamp" to a mixture of marsh gas and carbon dioxide, claiming that this combination is more dangerous than fire-damp. This advocacy is sure to meet

with some approval and thereby lead to an interesting discussion.

The treatment of dust as an explosive agent is the most interesting part of the book, although the differentiation, as to the explosive quality between the dust from different kinds of coal is not entered into. The relative importance of the physical, as compared with the chemical qualities, of coal dust is conceded, but conclusions so far are vague. The relation of atmospheric pressure to mine explosions is touched upon only in a general way, while the author has the courage to draw a definite connection between subterranean or seismic disturbances and the spasmodic flow of gases into mines, thus giving rise to periods of frequency of mine explosions.

The chapter on safety lamps is complete and valuable for reference. The author condemns as pernicious the practice of reducing the circulation of air in a mine at the time of firing; this, like many other points discussed, is a matter of dispute; many experienced mining men claim that when shots are fired at night after the miners have left the workings, the speed of the fan should be materially reduced, thereby decreasing the volume of the air current. This contention is advanced, because when an explosion occurs, especially a dust explosion, it travels against the air current, and the larger the volume of air entering the mine the greater the damage will be.

ENGINE-ROOM CHEMISTRY. By Augustus H. Gill. Pp. 198; illustrated. 5x7 in.; cloth, \$1. New York and London, 1907: Hill Publishing Company.

Contents. Introductory. Apparatus and chemicals. Fuels and their analysis. The regulation of combustion. Water, boiler scale, pitting and corrosion. Mineral oils. Animal and vegetable oils. Appendix.

This is a thoroughly satisfactory little book. The chemist will consider it elementary, and so it is. It was not written for the chemist, however, but rather for the engineman in order to give him some familiarity with the properties and behavior of the substances—water, oil, coal, etc.—with which he is directly concerned. Professor Gill, who is a distinguished chemist, has displayed great art in explaining the chemical principles of his present subject in a clear, simple way. His book is one from which the men who are in charge of engines—and also, we venture to say, many of their superiors—may derive great profit.

THE COPPER HANDBOOK. Vol. VII. Horace J. Stevens. Pp. 1228. 6x9 in.; cloth, \$5. Houghton, Mich., 1907: Horace J. Stevens.

Contents. History of copper. Geology of copper. Chemistry and mineralogy of copper. Mining of copper. Milling and concentrating of copper. Hydrometallurgy of copper. Pyrometallurgy of cop-

per. Electrometallurgy of copper. Alloys of copper. Brands and grades of copper. Uses of copper. Substitutes for copper. Glossary of mining terms. Copper deposits of the United States, Canada, Newfoundland, Mexico, Central America, Antilles, South America, Europe, Africa, Asia, Australia and Oceania. Copper mines of the world. Statistics of copper.

This is the seventh renewal of the well-known manual of the copper industry of the world, which serves as a popular text book and as a record of the mining operations of the principal producers of copper. It is a remarkably complete directory of the copper mines of the world, and serves many useful purposes.

THE METALLURGY OF THE COMMON METALS. Leonard S. Austin. Pp. 407; illustrated. 6¼x9¼ in.; cloth. San Francisco, 1907: Mining and Scientific Press.

Contents: General. Roasting. Gold. Silver. Iron. Copper. Lead. Zinc. Refining. Commercial.

That there is need of a book of this kind, covering concisely the principal points in the production of the common metals according to American methods, no one will deny, for the chief books previously published deal principally with practice in other countries. Therefore Professor Austin's volume forms a welcome addition to our literature, and particularly so because his treatment of lead and copper smelting, two of the most important subjects dealt with, is unusually good. While the book, because of its small size, is useful as a handbook for practicing metallurgists and mining engineers, we think that its chief value will be as a textbook for students in conjunction with lectures, because the method of treatment is elementary, and there are some parts that are incomplete. The most notable example of this is the metallurgy of steel which is entirely omitted; also the hydraulicking of gold ores, lime roasting, certain processes for the amalgamation of silver ores, etc. Moreover, the cost of processes given so frequently in the volume and chapter on the commercial aspects of the subject adds a touch which always serves to awaken the interest of students even out of proportion to its undoubted value.

In one or two respects the book shows a lack of care in its final make-up. For example, on some of the figures (note 49, 54, 85, etc.), the text calls for designating letters which, however, have been omitted. Another example is on pp. 36-38, where each of three illustrations has the title belonging to one of the other two.

The Mexican International Railway has let the contracts for a branch of 16 km. long, which will extend from Sabinas to the new coalfield which is being developed by the Cloete company.

Statistics of Wisconsin Zinc Ore

The Joplin district has been noteworthy for many years, above all other mining districts of the United States, for the excellence of its statistics of ore production, published weekly. These statistics have been of great value to the zinc industry. About three years ago, when the zinc-mining region of Wisconsin, Illinois and Iowa began to come into great prominence, the ENGINEERING AND MINING JOURNAL determined to provide a similar service for it, although there were serious difficulties to surmount, among them being the scattering of the mining operations over rather a large area and the absence of so good means of communication as in the Joplin district. However, an effective system was devised through the co-operation of E. W. Moore, manager of the Galena Iron Works, Galena, Ill., who was then correspondent of the JOURNAL in this zinc region, and since that time we have given the miners of that region and the zinc industry in general weekly statistical reports through our columns, which service has been well appreciated as is manifest from the reproduction of our statistics in many journals (almost uniformly without credit, although it is to be said to the honor of the *Lead and Zinc News* of Joplin, Mo., that it offered to share the expense of collecting the statistics).

After Mr. Moore left Galena in order to become connected with the Ingersoll-Rand Company, his work as correspondent for the JOURNAL was taken up by J. E. Kennedy of Platteville, Wis., who continued the collection of the statistics. Recently one of his reports was criticized in the *Galena Herald* by J. H. Lewis, of Benton, Wis. Mr. Kennedy has replied to this criticism in a letter printed in the Platteville JOURNAL, of which the following is a part.

"The insinuation is made that the local correspondent of the ENGINEERING AND MINING JOURNAL, J. E. Kennedy, makes a habit of sending weekly to that publication unreliable and misleading statistics.

"The charge made by Mr. Lewis that an incorrect ore tonnage report was credited to Benton for the last week of February is entirely false. The figures reported by the ENGINEERING AND MINING JOURNAL, covering the instance at issue, viz.: zinc ore 339,100 lb. and lead ore 58,360 lb., have been duly verified and the writer of this communication has in his possession over the signature of the Northwestern Railway agent at Benton, D. C. Babcock, a statement that the above figures are absolutely correct.

"The inflated figures given out by Mr. Lewis, and claimed by him to be taken from the same source as were the correct figures, credit Benton with shipping during the week in question something 'in

excess of 900,000 lb. of zinc ore, with a quantity of lead ore.'

"The correspondent of the ENGINEERING AND MINING JOURNAL gathers the weekly ore shipments in the following manner: All agents along the Northwestern line report every Saturday morning, by telegraph, the ore tonnage shipments of their respective stations to Mr. Patterson, local agent of the Northwestern Railway, and a carbon copy of the original statistics is handed to the writer; the shipments out of Platteville over the C. M. & St. P. Railway, are taken directly from the company's impression books, from Saturday to Saturday. The shipments from Mineral Point, Kodatz, Harker, Linden and Highland are obtained by long distance telephone from the agent of the C. M. & St. P. Railway at Mineral Point. Shipments from other minor camps are likewise obtained through the courtesy of the carriers, except in the instance of Dubuque, where, owing to conditions, they are obtained by telephone from the secretary of the Avenue Top mine, which as the only regular shipper, represents the tonnage of Dubuque.

"The ENGINEERING AND MINING JOURNAL stands preëminently for reliability and spares no expense to obtain authenticity."

The Royal School of Mines

SPECIAL CORRESPONDENCE

The annual dinner of the old students of the Royal School of Mines, in London, always brings together a large number of mining men and this year the dinner was well attended as usual. The chair was occupied by Richard Pearce, past president of the American Institute of Mining Engineers, who was a student at the school in 1859. Mr. Pearce, who has had a distinguished career in America, where he was in the front rank in metallurgical circles, naturally seized the opportunity of telling his audience how much he was indebted to the instruction given him at the old school by Dr. Percy and Dr. Hofmann for the success that he afterward attained in his long professional life. In the course of an interesting speech he pointed out that the demand for highly trained men was never greater than at present. "Mining," he said, "should no longer be clouded with the uncertainties which obtained in early days, when guess work and rule of thumb held their sway. Intelligent scientific and business qualifications are increasing in demand, and mining is gradually being freed from the dreamy and speculative position which has characterized its past history."

The changes that are now being made in the organization of the school, which is in future to form a branch of the newly constituted Imperial College of Science and Technology, were, of course, referred

to by many of the speakers. And it was made clear that no effort would be spared by the governing body to maintain the high standard of education for which the school has so long been famous.

Among those who attended the dinner was Dr. H. T. Bovey, late of McGill University, Montreal, who has been appointed first rector of the Imperial College of Science and Technology. One point in the speech that he made is specially worth drawing attention to, namely, the great advantage that mining schools in America had derived from close connection between the professors and men engaged in practical work. This is due largely to the extent and variety of mining operations there, while in Great Britain metal mining is on a limited scale only.

The Transvaal Stope Drill Competition

The Transvaal Government, in co-operation with the Transvaal Chamber of Mines, has arranged for a practical trial of small rock drills suitable for narrow stoping work under the working conditions obtaining on the Witwatersrand. All types of rock drill are eligible to compete. Drills using compressed air will be supplied with a pressure varying from 60 to 75 lb. per square inch at the working face. The mining regulations require the provision of dust-allaying appliances, and competitors must make provision accordingly.

Two prizes, of £4000 and £1000 respectively, are offered. The trials and the judging will be so arranged as to decide which machine performs the most economical work.

The competition will commence early in 1909, and entries will probably close with the end of 1908. The trials will last about six months, the drills being tested in the first instance on the surface, and those considered suitable being given a more prolonged test underground in several stopes in various mines on the Witwatersrand.

The detailed conditions governing the competition, including the exact date of closing entries, will be published as soon as possible. All inquiries should be addressed to either the secretary, Stope Drill Competition, Transvaal Chamber of Mines, Johannesburg, Transvaal; or to the London secretary, Transvaal Chamber of Mines, 202 Salisbury House, Finsbury Circus, London, E. C., England.

Exports of antimony ore from France in 1907 were 3460 metric tons, against 3541 tons in 1906; and of antimony regulus, 1271 tons in 1907, against 872 tons in 1906. Imports of antimony metal are practically nothing, but imports of antimony ore amounted to 512 tons in 1907, as compared with 133 tons in the preceding year.

The Bureau of Mines Bill

In Washington, April 13, the House Committee on Mines and Mining agreed to recommend the passage of a bill, drawn by a sub-committee, for the establishment of a Bureau of Mines in the Department of the Interior. By the terms of this bill it shall be the province and duty of the new bureau "to foster, promote and develop the mining industries of the United States; to make diligent investigation of the methods of mining, and of the safety of mines; the possible improvement of conditions under which mining operations are carried on, the treatment of ores, the use of explosives and electricity, the prevention of accidents, the values of mineral products and markets for the same, and of the other matters pertinent to said industries; and from time to time to make such public reports as the Secretary of the Interior may direct of the work, investigations and information obtained with the recommendation of such bureau." Provision is made for the management of the bureau, under the Secretary of the Interior, by a commissioner, to be appointed by the President at a salary of \$6000 annually.

Mineral Production of Great Britain

The Home Office Mining Department has issued its annual preliminary return, showing the quantities of coal and other minerals raised in the United Kingdom in 1907, together with statistics as to the persons employed.

COAL

The quantity of coal mined in the United Kingdom, which was 251,050,809 long tons in 1906, advanced to 267,828,276 tons in 1907; an increase of 16,777,467 tons, or 6.7 per cent. In addition to this a few thousand tons are obtained from open workings. This quantity is not yet reported, but it is too small to affect the general result.

Of the coal mined in 1907, England furnished 187,383,846 tons; Wales, 40,252,178; Scotland, 40,092,548; Ireland, 99,704 tons.

OTHER MINERALS

The production of minerals other than coal from mines coming under the Coal Mines act was as follows, in long tons:

Mineral.	1906.	1907.
Barytes.....	7,199	10,297
Clay and shale.....	252,275	320,889
Fireclay.....	2,971,173	2,890,197
Igneous rocks.....	424	146
Iron pyrites.....	7,342	7,394
Ironstone.....	8,209,880	8,236,118
Limestone.....	32,816	22,366
Oil shale.....	2,546,113	2,675,779
Petroleum.....	10	
Sandstone (including gaster).....	126,675	128,103

Clay and shale do not include fireclay and oil shale, which are reported separately.

In addition to the iron ore reported above, a considerable quantity is obtained from open workings, which come under the terms of the Quarries act. This production from quarries is not yet reported.

The number of persons employed in workings coming under the Coal Mines act was: Underground, 757,887; on surface, 182,731; total, 940,618. This is an increase of 58,273 over the previous year, indicating an active year in mining.

METALLIFEROUS MINES

The following table shows the output of various minerals under the Metalliferous Mines regulation acts during 1907, as compared with 1906, in long tons:

Mineral.	1906.	1907.
Arsenic.....	1,599	1,473
Arsenical pyrites.....	640	679
Barytes.....	27,827	30,343
Bauxite.....	6,654	7,537
Chalk.....	2,902	1,765
Chert and flint.....	4,912	5,372
Clay and shale.....	118,521	114,525
Copper ore and precipitate.....	7,758	6,759
Fluorspar.....	36,280	40,229
Gold ore.....	17,384	12,978
Gypsum.....	196,143	195,266
Igneous rocks.....	72,722	69,871
Iron ore.....	1,824,415	1,803,063
Iron pyrites.....	3,798	2,800
Lead ore.....	30,226	31,215
Limestone.....	765,718	470,263
Manganese ore.....	22,762	16,098
Ocher,umber, etc.....	4,415	4,789
Oil shale.....	409	210
Rock salt.....	230,558	243,345
Sand.....	12,642	23,580
Sandstone.....	168,077	156,324
Silver ore.....	1	4
Slate.....	126,699	116,570
Tin ore (dressed).....	6,276	6,087
Uranium ore.....	11	71
Wolfram.....	263	312
Zinc ore.....	22,824	19,945

There was also produced in 1907, a total of 80 tons of mixed ores containing arsenic, copper, tin and tungsten.

The number of men employed at metalliferous mines in 1907 was: Underground, 18,559; above ground, 13,008; total, 31,567. This is an increase of 1336 over the previous year.

Prices in Trade Reaction

In the course of a public denial, April 9, that reduction in steel prices is contemplated by the United States Steel Corporation, Judge Gary, chairman of the board of directors, thus explained the company's position:

"Prices should at all times be reasonable and fair. The mere fact that the demand is greater than the supply—that the necessities of the purchaser are great—does not justify an increase in price; nor does the fact that the demand is less than the supply furnish an argument for lowering the price. In neither case would the quantity bought and sold be more or less."

And he added that not only manufacturers, but also purchasers, desire stability in prices rather than violent and sudden fluctuations.

As regards the fact that the company did not, in the abnormal demands by consumers a year or two ago, exact as high prices as it might have done, Judge Gary speaks the truth. But it will nevertheless be asked by a good many people, says the *Evening Post*, whether we are not being asked to accept some queer political economy.

Judge Gary flatly denies that excess of supply over demand is a proper cause for a change in prices. But if it is not, then what is? There are only two other conceivable causes, viz, cheapening of the cost of manufacture such as should make maintenance of old prices unjustifiable, or absolute necessity on the seller's part to turn his merchandise into cash. As to the first of these alternatives, the prices of bessemer pig iron at Pittsburg last week was \$15.40 per ton; a year ago it was \$23.35; it was higher still in May and June. The present price is the lowest since 1904; but when iron declined from \$22 to \$12.50 in that period, steel billets were also cut from \$30.50 to \$19.50. This argument is, therefore, against maintenance of prices. As for the argument from the necessity alone of the producer, that would simply mean that a corporation which could keep its finances and its control of trade strong enough to refuse reduction at any time, would be justified in never reducing them. But this is the argument of monopoly.

If there is no reason why prices should change in response to changed relation between supply and demand, then the grain trade, the cotton trade, and the mercantile trade in general are now and always have been based on an absurdity. From this assumption, there would be only one step to an advance of prices in the face of increased supply and reduced demand.

World's Production of Copper

Aron Hirsca & Sohn, Halberstadt, Germany, in their annual statistical publication, issued in February, give 706,460 tons as the world's production of copper in 1907, a decrease of 46,440 tons as compared with the figures for 1906. Of the total for 1907 the United States contributed 52.9 per cent., considering the production of the mines alone; the addition of the refined metal produced from imported smelter products, increases this total to about 68 per cent.

Of the other copper-producing countries Mexico contributed 8.2 per cent. of the world's production; Spain and Portugal, 7.2; Australia, 6.5; Japan, 5.6; Chile, 4; Germany, 3.4; Canada, 3.3; Sweden and Norway, 2.6; Russia, 2.1; Peru, 1.4; South Africa, 0.8; Italy, 0.4; Bolivia, 0.3; New Foundland, 0.3; Austria-Hungary, 0.1; Turkey, 0.3; and other countries, 0.3 per cent.

Personal

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

E. C. Small, of Chicago, is examining some mines in Pachuca, Mexico.

Allen H. Rogers, of New York, has gone to Mexico, and will not return until May 10 next.

H. Mortimer Lamb, secretary of the Canadian Mining Institute, is in New York on business.

C. P. Hill, manager of the Hillcrest coal mine, at Frank, Alberta, is in Ottawa, on business.

A. Gustavson, of Oakland, Cal., has arrived at Fortymile, Yukon, for the season's operations.

J. Parke Channing, president of the Tennessee Copper Company, has gone to Europe for a brief visit.

Dr. William B. Phillips has returned to Birmingham, Ala., after examining several mines in the State of Oaxaca, Mexico.

Adolph Lewisohn, president of the United Metals Selling Company, has gone to Europe, where he will be for about six weeks.

C. L. Kurtz, president of the Guanajuato Reduction and Mines Company, is on a visit to the properties in Guanajuato, Mexico.

H. C. Holthoff has been appointed manager of the new office established by the Allis-Chalmers Company in the City of Mexico.

W. F. Harrison has been made manager of the Indé Gold Mining Company, Indé, Durango, Mexico, to succeed C. J. Stone, resigned.

S. H. Brockunier, of New York, has gone to California to make examinations of several copper and gold mines for an eastern syndicate.

C. Colcock Jones has returned to Los Angeles from an examination of properties in the Hart district, San Bernardino county, California.

J. W. Bryant, mine superintendent for the Tye Copper Company, Ltd., has returned to British Columbia from a business trip to Mexico.

F. F. Sharpless, consulting mining engineer, New York, has gone to Mexico on professional business, which will occupy him about a month.

The firm of Harrington & Twining, mining and civil engineers, has been established, with office at 301 Brooks Arcade, Salt Lake City, Utah.

J. R. Finlay, consulting mining engineer, New York, has gone to Joplin, Mo., on professional business which will occupy him about 10 days.

T. R. Drummond, formerly with the

Nipissing company, has been appointed manager of the Cactus mine of the Newhouse Mines and Smelters, Utah.

James D. Hurd, general manager of the Crow's Nest Pass Coal Company, Ltd., left Fernie, B. C., on March 27 on a three week's trip to the United States.

H. A. Buehler, at present assistant State geologist, has been appointed geologist to succeed Dr. E. R. Buckley, resigned. Mr. Buehler will take charge May 1.

W. A. Butchart, manager of the Mexico Mine and Smelter Supply Company since 1905, has resigned, principally on account of his health, and will probably leave Mexico.

H. Nestor-Schnurmann, of London, has been appointed metallurgist to the Anglo-Spanish Copper Company, Ltd., owning the San Vicente mines in the province of Huelva, Spain.

Lewis Stockett, manager of the Canadian Pacific Railway Company's coal mines in Alberta, Canada, has removed his headquarters from Bankhead, Banff, to Hosmer, Crow's Nest Pass.

John M. Ruffner, manager of the North Columbia Gold Mining Company, and the Pine Creek Power Company, in Atlin camp, B. C., has returned from the United States for the season.

Dr. T. R. Marshall, of Glasgow, Scotland, is on his way to Argentina, where he will take charge of some mining property for its Scottish owner. It is the doctor's intention to visit Chile and Peru also.

Alfred James, consulting metallurgical engineer, of London, Eng., who has been in Mexico for several months, studying the cyanide practice there, sailed for home on the "Carmania" from New York, April 4.

John T. White, formerly agent for the Mineral Point Zinc Company, has accepted a position as ore buyer with the Hegeler Brothers Zinc Company, of Danville, Ill., with headquarters at Joplin, Missouri.

F. H. Sistermans, of Mexico City, who returned from Denver a few weeks ago, has left for the Isthmus of Tehuantepec, to examine some copper properties in which the firm of S. Pearson & Son is interested.

Samuel Graves, of Montreal, has been appointed editor of the publications of the Geological Survey of Canada, to succeed Francis J. Nicholas, who has been retired from that position, and is no longer connected with the Survey.

J. W. Parker, of Seattle, Wash., formerly manager of the mines of the Brown Alaska Company in Alaska and British Columbia, is examining mineral claims on Moresby island of the Queen Charlotte group, stated to be under option to the Tye Copper Company.

J. C. Dufresne has resigned as superintendent of construction at the Canadian Metal Company's Blue Bell mine, on Kootenay Lake, B. C., at which the erection and equipment of a 200-ton concentrating mill is about completed. S. S. Fowler, of Nelson, is general manager of this company.

W. H. Trewartha James, who has been appointed general manager of the Tye Copper Company, Ltd., arrived in Victoria, B. C., from London, on April 3. The company's head office in British Columbia has been removed to Victoria. Wm. Gardner, who has been in charge of the company's business in the province since the death of the late Clermont Livingston, left Victoria, April 10, on his way to London.

Dr. Samuel Walker Beyer has been elected dean of the School of Mines and Metallurgy of the Pennsylvania State College in the place of Dr. M. E. Wadsworth. He has been for many years head of the School of Mines of the Iowa State College at Ames, Iowa. He was educated at that institution and at Johns Hopkins University. He is a member of the Iowa Geological Survey, and assistant geologist on the U. S. Survey.

Dr. M. E. Wadsworth, dean of the School of Mines in the Pennsylvania State College, was elected last year dean of the School of Mines and Professor of Mining Geology in the Western University of Pennsylvania. The call was accepted with the understanding that he was to hold both position until Sept. 15, 1908, when he would take up his permanent residence in Pittsburg. This was done, to give the authorities of the Pennsylvania State College sufficient time to select a suitable successor.

Obituary

William R. Jenkins, of Bellefonte, Penn., a prominent inventor and treasurer and general manager of the Howard Iron Company, died on April 9.

H. C. Colvin, a well known mill man and metallurgist, died in Salt Lake City recently of tuberculosis. He was formerly superintendent of the Consolidated Mercur mill at Mercur, Utah, and the Bamberger-Delamar mill at Delamar, Nev.; later assistant superintendent of the Utah Copper Company's Copperton mill at Bingham, Utah.

A. W. Howitt, who died in Gippsland, Victoria, March 5, aged 78 years, was born in England and emigrated to Australia in 1850. He was prominent in the early days of gold mining and assisted in opening up several mining districts. In later years he devoted himself largely to exploring work, paying particular attention to the geology and ethnography of the country. He served for several years as secretary of mines of Victoria. He was the author of a number of papers on

geological and other questions, and had received a gold medal from the Australian Association for the Advancement of Science.

Societies and Technical Schools

Pennsylvania State College—The school of mines at this institution will be reorganized and expended into four departments, mining, metallurgy, geology, and ceramics. The teaching staff will be enlarged by the addition of several new professors and instructors. Dr. Samuel W. Beyer, late of the Iowa State College and the Iowa Geological Survey, has been elected dean of the school.

West Virginia State Mining Institute—A call has been issued for a meeting to be held in Clarksburg, W. Va., June 29 and 30, for the purpose of organizing a State mining institute. The call includes mining engineers, coal operators, mine officials, mine inspectors and miners. The object is to bring those interested together for the purpose of forwarding the mining industry of the State and for mutual education in practical and scientific mining. The chairman of the committee in charge of the organization is J. B. Hanford, general superintendent of the Elkins Coal and Coke Company, Morgantown; the secretary is John S. Cummings, Tunnelton.

Industrial

The Weber Steel Concrete Chimney Company of Chicago announces, that, owing to its increased field in taking other kinds of plain and reinforced concrete construction work, in addition to chimneys, it has been decided to change the name of the company, so that hereafter it will be known at the Weber Company. General offices, as before, 929 Marquette building, Chicago.

After having been run continuously on one lining for seven years, Eliza furnace No. 4, of the Jones & Laughlin Steel Company, is being repaired and rebuilt. During its operation with the one lining, the furnace turned out 1,202,056 tons of pig iron, and if business conditions had warranted it, the statement is made by the furnace officials that this output might have been increased to 2,000,000 tons before the lining had reached such a state as to demand its being replaced.

At the annual meeting of the Lake Superior Corporation last week a compromise was made by the conflicting interests, and the following directors were chosen: George Tatginson, Preston, Ont.; Wm. J. Sheppard, Charles D. Warren, Toronto; Thomas J. Drummond, O. R. Wilson-Smith, Montreal; Leander N. Lovell, Camden, N. J.; Francis B. Reeves, James Hay, Horatio G. Lloyd, Charles S. Hinchman, J. Tatnall Lea, Philadelphia;

John T. Terry, New York. The board elected Charles D. Warren, president; Francis B. Reeves, vice-president; John T. Terry, secretary and treasurer.

Recent orders for pumps taken by the John A. Traylor Machinery Company, Denver, Colo., include an electric sinking pump with a capacity of 300 gal. per minute under a head of 500 ft., for the Swansea mine at Silver City, Utah; two sinking pumps, one for 150-ft. and one for 300-ft. head, for the Chihuahua Copper Company in Mexico; a jig and pumping equipment for the Mary Queen Leasing Company, Red Cliff, Colo. Orders for drills include a compressor, air-hammer drills and fittings for the Central Mining and Development Company; eight air-feed drills for the Cieneguita Copper Company.

The Bristol Company, of Waterbury, Conn., has come under the control of Prof. William H. Bristol, whose inventions this company has been manufacturing since it was first organized in 1889. Professor Bristol assumed active charge of the management of the business on March 28, and now owns the majority interest. The business which has been carried on under the personal name of Wm. H. Bristol at New York will hereafter be combined with the Bristol Company, and by this consolidation of interests the Bristol Company will now have a complete line of recording instruments for pressure, temperature, electricity, and for a great variety of other applications.

On his recent visit to Birmingham, Ala., President Corey, of the United States Steel Corporation, authorized the following statement: "The plans approved by the former management of the Tennessee Coal, Iron and Railroad Company will be carried out practically without change. In addition, the following improvements will be recommended: Remodel blast furnaces Nos. 1, 2 and 3, about redoubling the product of these furnaces, or an increase of 600 tons per day. Install a new 600-ton metal mixer. Build four 100-ton open-hearth furnaces. Open No. 13 coal mines on Pratt seam. The above are the principal items. These improvements, of course, involve large outlays for additional boilers, engines and other machinery, as well as improvements and extensions to transportation facilities."

Trade Catalogs

Receipt is acknowledged of the following trade catalogs and circulars:

Covington Machine Company, Covington, Va. Covington Coke Drawing and Loading Machines. Pp. 23, illustrated, paper, 6¼x9 inches.

H. W. Johns-Manville Company, 100 William street, New York. Catalog No. 107. Asbestos Wood. Pp. 20, illustrated, paper, 3½x6 in.; 1908.

Erie Pump and Engine Company, Erie, Penn. Catalog F. Centrifugal Pumps, Gasolene and Steam Engines. Pp. 36, illustrated, paper, 6x9 inches.

Brown & Sharpe Manufacturing Company, Providence, R. I. Constant Speed Drive Milling Machine. Pp. 12, illustrated, paper, 4½x6½ inches.

Asbestos Shingle, Slate and Sheathing Company, Ambler, Penn. Asbestos Roofing Slates, Shingles and Sheathings. Pp. 66, illustrated, paper, 3½x6 in.; 1907.

Joshua Hendy Iron Works, San Francisco, Cal. Bulletin 108. Derricks, Winches, Hoisting Crabs, etc. Pp. 24. Bulletin 110. Eureka Fire Monitors. Pp. 8. Illustrated; paper, 7x10 in.; November, 1907.

Westinghouse Electric and Manufacturing Company, Pittsburg, Penn. Circular No. 1097. Westinghouse Types K and KG Motors. Pp. 20, illustrated, paper, 7x10 in.; October, 1907. Folder 4089. Westinghouse Type F. Circuit Breakers. Illustrated; September, 1907. Folder 4097. Westinghouse Alloy No. 18. Illustrated; July, 1907.

Crocker-Wheeler Company, Ampere, N. J. Bulletin No. 95. Belt Type Alternating Current Generators. Pp. 8, January, 1908. Bulletin No. 97. Direct Current Switchboard Panels. Pp. 16, January, 1908. Bulletin No. 98. Form L. Machines. Pp. 16, February, 1908. Bulletin No. 99. Crocker-Wheeler Motors in the Bethlehem Rail and Structural Mills. Pp. 8, February, 1908. Bulletin No. 100. Form I Machine. Pp. 16, March, 1908. All illustrated; paper, 7½x10 in.

Construction News

Placerville, California—At the Gold Hill mine new milling equipment, including crushing rolls, is to be put in. T. H. & N. Douglas, of Placerville, are owners.

Rollinsville, Colorado—The Champion Mining Company will purchase an air compressor and other machinery. S. P. Weller, Majestic building, Denver, Colo., is manager.

Perigo, Colorado—The Gilpin Independence Mining Company will remodel its mill and put in concentrating tables. O. Q. Beckworth, Exchange building, Denver, Colo., is manager.

Central City, Colorado—An electric plant will probably be put in at the Chicago-Carr mine, to replace an old plant destroyed by fire. Bruce M. Myers, Central City, Colo., is manager.

Brown's Valley, California—The Bessie mine is to be equipped with new machinery, including a stamp mill. An electric plant is also to be installed. Fred Searles and D. E. Morgan, of Nevada City, Cal., are at the head of the company.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives
at Salt Lake City, San Francisco, Denver and London

REVIEWS OF IMPORTANT EVENTS

San Francisco

April 10—It looks now as if another great gravel mine in California had been discovered in the Jenny Lind, of Grass Valley, Nevada county. After running nearly 1500 ft. of tunnel and paying assessments for about three years, good coarse gold was found in an upraise 28 ft. from bedrock in the tunnel. This is supposed to be the old Alta Hill blue lead, from which so much gold was taken years ago, and the channel of which was lost. The company has been in gravel for some time, but not of a paying character, until this genuine blue-lead gravel was struck. The strike was made in the lower tunnel, which will be run another 100 ft. before they begin to breast out. There is now a proposition to combine the Jenny Lind and Posey Cañon properties, with intervening ground, and operate the entire acreage on a large scale. If this is carried out it will be one of the greatest gravel mines in the State, about equal to La Grange hydraulic mine of Trinity county. The gravel in the Nevada county mines would, however, be drifted and milled.

All the bed of the Sacramento river from Salt creek, two miles above Redding, Shasta county, to Cottonwood creek on the Tehama county boundary line, has been located during the past few weeks as placer ground for dredging purposes. The strip covered by the locations is about 10 miles long, or the entire frontage of the old Redding grant made to Major Redding by the Mexican Government. The eastern boundary of this grant does not conform strictly to the banks of the river. The straight lines of the survey leave little patches of ground in the crooks of the river outside of the grant. Although these patches have been considered as belonging to the State, they have always been claimed by the abutting farm owners. But now the miners have located the river bed, and have laid claim to all these patches of ground as part of their placer claims.

At the Alpine mine, Georgetown, El Dorado county, they have struck the vein in the 300-level drift, and it shows free gold and a good percentage of sulphurets. This is an old mine which was worked a couple of hundred feet and then given up because deeper exploration was too expensive at the time. Senator Wixon and George Wingfield, of Nevada, took hold of the property not long since, and are now about to install heavier and more modern hoisting and milling machinery.

The Georgetown Divide has been pretty thoroughly prospected for nearly 60 years, but a large proportion of the veins were given up at about the water level.

Goldfield, Nev.

April 6—This week has witnessed strikes on the Florence ground which, had they occurred 18 months ago, would have thrown the whole community into a tumult. Today 48 sacks were taken to the mill of the Western Ore Purchasing Company under armed guards. The Little Florence lease has produced up to date \$1,302,794. It is reported that John W. Gates has become interested in the Little Florence, through a new company to be called the New York Florence Leasing Corporation, to open up some virgin ground to the north of the present workings.

To the south and adjoining the Little Florence is the Rogers Syndicate Lease, which has been shipping about 45 tons of ore per day, but has this week struck bonanza rock and has already marketed some very rich stuff.

The three leases—Little Florence, Rogers Syndicate and Mohawk Florence—have produced to date \$1,584,300. This production has been made in six months, and all the ore shipped has averaged over \$200. The Little Florence lease expires this month, but the Rogers lease runs until July 11 next.

The Miners' Union this week voted to declare at an end the strike which has existed here for five months. This marks the control of the conservative element. At this meeting any man was allowed free voice, which has never been the case before since the union was organized here by the agitators on the birth of the camp. This action, while helping to restore confidence and good feeling, does not affect the situation very much, as all the mines are operating and the camp is no longer a union camp. Non-union and union men work together in harmony and wages range from \$4 up, some of the leasers paying big bonuses.

Samuel Newhouse paid a brief visit to this camp this week.

Salt Lake City

April 9—Much satisfaction has been expressed over the advantage gained by the United States Smelting, Refining and Mining Company in the Federal court

through the suspension of the decree of injunction which will permit the operation of the lead smelter at Bingham Junction. It will probably be the latter part of June or July, however, before any furnaces are in operation, on account of the great amount of construction required in the retirement of the hand-roasters and installation of the converter-roasting plant, as well as other improvements to be made in connection with the system devised for the conserving of gases. This process was discovered by metallurgists in the employ of the United States company, and application for a patent has been made.

The application of the bag-house for the treatment of roaster gases has not been possible, because the sulphuric-acid gas formed in the process would destroy the bags. But to permit these gases to escape meant destruction of crops. To remove the sulphuric acid was, therefore, the problem. The roaster is to consist of a rectangular box, fitted with a perforated bottom through which air will be blown. The ore, consisting of a mixture of fine and coarse material, will be fed into this box. No other material will be fed into the box and the sulphur in the ore will furnish fuel for the roast. The gases which are formed in this process will be carried into a room into which air and zinc oxide will be blown. The zinc oxide will be impalpable and will be carried along through the flues, with the flue gases, mixing thoroughly with them. This operation gives the sulphuric acid plenty of time to react with the zinc oxide before the bag-house is reached. The compound formed is stopped by the bags. It is said the company will expend something like \$160,000 in the proposed improvements.

At the large concentrating mill of the Boston Consolidated at Garfield during the first week of April the average extraction was 70.8 per cent. Mill manager Bettles has made the statement that an extraction of 75 per cent. can be made on ores containing from 1.8 to 2 per cent. copper. Only three sections of the plant are in commission and it is unlikely that any more will be put into service for some little time as the mine will not keep the mill supplied.

The Weimer Company was promoted last year by John B. Weimer and others, who disposed of about \$50,000 worth of stock and sold ore to the value of about \$25,000. The company is in debt and the claim is made that the properties which

formed the basis for the organization of the company have not been paid for. The stock was sold extensively in Duluth and in other cities of the East.

The annual report of the Carisa Mining Company for 1907 has been issued. The mine is in the Tintic district. The report shows net earnings amounting to \$78,649. During the year 7481 tons of ore were sold. The smelting companies were paid \$31,320 as treatment charges; the railroads received \$30,054 for freights and \$34,614 went for labor.

The boom camp of Rawhide, Nevada, has attracted but little attention in Salt Lake. Some prominent mining men from Salt Lake who have visited Rawhide, are not enthusiastic about the camp.

The Daly-West mine and mill at Park City have been closed. Ernest Bamberger, the manager, states, however, that work will be resumed in two or three weeks when the mine shaft has been repaired; while that work is going on, some of the machinery will be given a thorough overhauling. As has been the case with other Park City mines, the property has been operated with a small crew of men, since the beginning of the year.

The Garfield mill of Utah Copper Company is now treating 4500 tons of ore per day, for the ninth section has just been completed. At the mine in Bingham, six steam shovels are working; another steam shovel has been ordered which is to be held in reserve. Between 11,000 and 12,000 tons of ore and overburden is being moved each day by the shovels. During the month of February the company oversold its spot copper about 4,000,000 pounds.

The driving of Mascotte tunnel near Bingham, is progressing satisfactorily and is now within 300 ft. of the point where a raise will be started to connect with the main Ohio workings.

Denver

April 10—The first of the Government's big coal-land fraud cases, set for trial at Pueblo, was dismissed April 7. It was against John A. Porter, formerly president of the Porter Fuel Company, of Durango, for the alleged illegal securing of some thousands of acres of coal lands. The new United States attorney, just appointed, apparently became convinced of the weakness of the case, and so recommended its dismissal, which was accordingly done.

In the long drawn out suit of Josiah Winchester vs. A. M. Stevenson, involving the sum of \$500,000, in connection with the Doctor and Chief claims and the Doctor-Jack Pot Consolidated Mines Company, of Cripple Creek, the referee appointed by the court has decided in favor of the defendant, Stevenson, the finding being that Winchester owes the former \$6757. Judgment was deferred until the attorneys for the plaintiff deter-

mine whether or not they will appeal to the Supreme Court.

The report of J. Arthur Connell, president of the Work Mining and Milling Company, of Cripple Creek, shows a net profit on the year's working of \$78,500, and \$75,000 distributed in dividends. These profits were derived from royalties on ore extracted by some twelve sets of lessees, the company's share being 25 per cent. on the net smelter returns. The treasurer's statement shows a cash balance on hand of about \$85,000.

The Portland Gold Mining Company, of Cripple Creek, has declared the regular quarterly dividend of 4c. per share, a total of \$120,000, making the total of dividends paid to date by this company, \$7,867,000.

The report of T. J. Dalzell, State commissioner of mines, gives the value of Colorado's mineral output for last year at \$41,402,416, of which nearly \$14,000,000 was credited to Cripple Creek.

Butte

April 14—Operations in the district continue along conservative lines; copper production will be restricted until there is a decided improvement in the general business and financial conditions of the country. About 8000 tons of ore are being shipped to the Washoe smelter daily from the Butte mines; formerly 10,000 tons was the average. The North Butte company mines about 1200 tons per day, the Butte Coalition 1000 tons, and the remainder comes from the Amalgamated mines. About 5500 men are employed in the mines of the three companies against about 7500 under former conditions. John D. Ryan, managing director of the Amalgamated company, says the Butte mines are producing copper as cheaply as it can be produced anywhere in the world, the average of all the mines being as low as the average elsewhere.

London

April 3—The Nundydroog is one of the large mines of the Kolar goldfield in southern India. The report of the directors for the year 1907 has recently been issued and records a prosperous year. The total dividend is 3s. 6d., or 35 per cent. on the 10s. shares. It is proposed that in the future all capital expenditure shall be provided for out of profits, a policy which John Taylor & Sons, the managers, are also inaugurating at the other mines belonging to their group, and which is no doubt sound finance in the case of old established mines.

The Kolar mines are now supplied with electric power from a central power station. The cost at the Nundydroog is now as low as £10 per horse-power per annum. The ore treated during the year was 84,000 tons, from which gold to the value of £283,138 was recovered, equal to

67.4s. per ton or 15.8 dwt. fine gold. The mill is one of 80 stamps, of small weight (840 lb.) in comparison with Rand stamps. The duty was 3.03 tons per head per 24 hours crushing through a 1/30-in. mesh screen. The report is well prepared and full of information, but has the defect of not showing the costs distributed departmentally. The gold returns too are given in standard and not fine ounces, and it is uncertain whether the tons are long tons or short. The engineers of the company would be doing a service to the mining profession if they would fall in line with practices of the Transvaal, Australia, and the United States in reporting production in fine gold. The costs, according to the revenue account, were £142,475. In addition the sum of £23,636 was written off for depreciation, buildings and mine expenditure, making together £166,111, or 3).5s. per ton, which is a high working cost.

The affairs of the Anglo-Spanish Copper Company, Ltd., reveal the unbusiness-like manner in which some mining companies are formed in London. This company was registered in January, 1907, with a nominal capital of £300,000 to purchase some copper mines in the Province of Huelva, Spain. The purchase consideration was £170,500, of which £165,000 was paid in shares and £5500 in cash. After the formation of the company the subscribing shareholders appear to have doubted the truth of the statements put forward by the vendors as to the value of the property, and called in other engineers who reported unfavorably. The subscribing shareholders were then in a dilemma. The vendors held the majority of the shares, and if liquidation was agreed on, a large portion of the cash subscribed would go to the vendors, who would then give their property back plus part of the money subscribed for working it.

Meetings have been held to try to come to some amicable agreement and it is now proposed that a limited sum shall be spent on testing the value of the mine and at the end of an agreed period the subscribers can decide whether they want to relinquish the property and take back the balance of the working capital, or to go on.

This is perhaps the best arrangement that can be made. The subscribers are certainly to blame for not having taken sufficient advice at the start as to the value of the property they were investing in. They can, however, congratulate themselves on having the chance of saving something. In many ventures not only all the working capital goes, but the shareholders are frequently tempted to put in more, which they lose also. The moral to be drawn from this episode is that it is worth while for an investor in mining property to take sound professional advice before risking his money.

Mining News from All Parts of the World

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

THE CURRENT HISTORY OF MINING

Arizona

COCHISE COUNTY

Copper Queen—The new power house, which will furnish the light and power for the eight shafts of the company, has been completed. The cost of the plant will be \$1,500,000 approximately. The 125-ft. addition to the smelter has been completed. The building is thus enlarged so that two more 500-ton furnaces can be accommodated whenever there is a demand for their construction. The Queen production for the month of March was about 7,500,000 lb. copper.

Calumet & Arizona—This company has declared a dividend of \$1 per share, payable April 25. It had been thought by many that the dividend would be passed, following the practice of the other copper companies, but the directors at a meeting held in Bisbee decided to make the above distribution.

Bisbee-Duluth—The largest deal so far this year in the Warren district was the purchase by this company of the Corning & Pinyan group of claims for \$400,000. This ground joins the property of the Warren Development Company. The company will start development in early summer.

Calumet & Arizona—During the month of March the copper product of the smelter amounted to more than 4,000,000 lb. Five furnaces are operated to the limit of their capacity, and construction is being rushed on a new 500-ton furnace, which is expected to be ready in June.

Warren Development Company—An important orebody was encountered on the 540-ft. level of the property of this company. This strike proves the work of the diamond drill.

Warren-Bisbee Electric Railway—This line, which connects Warren, Lowell and Bisbee, has been completed, making one great camp of the Warren district.

GILA COUNTY

Miami Copper Company—The treasury stock (200,000 shares) of this company, recently offered, was over-subscribed.

GRAHAM COUNTY

Arizona Copper Company, Ltd.—Production for March was 1548 tons copper. This includes the clean-up for the half year.

YAVAPAI COUNTY

Spar Gold and Copper Mining Company—This company has sold its mines near Mayer, to the Pocahontas Mining Company, which is equipping the property with the necessary machinery to develop to a depth of 1000 ft. Steam will be the power used. The Spar company has taken out and shipped 67 cars of high-grade copper-gold ore. The mine is developed to a depth of 300 ft.

Spec Gold Mining Company—This company, operating on Lynx creek, eight miles east of Prescott, is installing a digging machine on its dredge. The bars are found to be too hard for economical handling without some kind of machine to loosen up the gravel. It is said that the recovery being made by the dredge so far is satisfactory.

Monica Mines Company—The Monica mill is again in operation after a shut-down of about two weeks to make needed changes. The ore milled so far has proved better than was expected. The mine is near Kirkland, in the Weaver district.

Gold King—These mines situated near Crown King, will again be operated by the Gold King Mining Company; work was discontinued last September at the time of the money stringency.

Humboldt Smeltery—It is reported that the operations will be resumed about June 1. A large number of mines in this county will resume operations as soon as the smeltery is again buying ore.

California

BUTTE COUNTY

Mammoth Channel Gold Mining Company—At this property, Magalia, the tunnel only lacks 100 ft. of completion. R. M. Ingraham has been appointed superintendent, in place of C. B. Locklin.

CALAVERAS COUNTY

Boston—This old mine at Mokelumne Hill is to be reopened by San Francisco men who have bonded it. The mine has been closed down for eight years. The shaft is 100 ft. deep, and there is a hoist and mill on the property.

EL DORADO COUNTY

Collins-Bacchi—This old mine near Garden valley, owned by S. W. Collins, has been leased to a company which is now working it.

Gold Hill—T. H. and N. Douglas have

purchased this mine, near Placerville, from Mrs. W. T. Slocum, of Oakland, California. Mills are to be put in for crushing the large amount of ore in the old dump.

Peasley—In this mine, near Nashville, recently bonded to a company, a small streak of rich ore has been struck and is being crushed in the five-stamp mill.

Wagner—This mine at Bear creek, near Kelsey, is shipping ore to Coloma cañon to be milled.

HUMBOLDT COUNTY

The Santa Cruz Company, owning the copper properties at Patricks Point, plans to haul the ore to Trinidad and then ship by rail to Eureka, transshipping from there to San Francisco smelters. It proposed later to put in a cable at Patricks Point so as to load vessels there.

INYO COUNTY

John L. Ramsey has sold to Al. Goucher, of the Valley View Company, at Skidoo, half interest in the Leroy, Myrtle, Cora, Copper Queen, and Rose Queen mines.

KERN COUNTY

Gold Flint—In this claim at Randsburg, owned by Andrew Nixon and W. C. Wilson, a 2-ft. streak of high-grade gravel has been found.

Pacific Mining Company—This company is about to commence active work on the Madera, Pearl Wedge and Merced mines in the Stringer district, near Randsburg. Water has been piped to the mines and a hoist has been put up, fitted to sink to 500 ft. depth.

San Antonio—J. W. Whittenmeir has taken an option on certain interests in this mine at Dave Springs, and development work will soon commence.

MARIPOSA COUNTY

J. S. Phillips, who has been working quartz in an arrastra for the past year from his claim four miles from Coulterville, is putting upon it the hoist and 20-stamp mill purchased from the Amador Phoenix and Amador Queen mines in Amador county.

Exchequer Mining Company—The new dam, 42½ ft. high, recently completed, now has a large volume of water running over it. Some of the power is used at the Exchequer and some at the Mt. Gaines mine, the rest being for sale.

Omparisa Mining Company—This company on the Merced river has cut a 6-ft.

vein of milling ore in the drift it has been running for some months.

Pocket—Henry Pearson has found a blind "stringer" at White's gulch, four miles from Coulterville, and has taken out several thousand dollars in a few days. Numbers of miners have gone prospecting in the vicinity of the find.

MONO COUNTY

Masonic District—The 10-stamp mill erected last fall is steadily at work on ore from the Liberty-Pittsburg. At that mine some fine ore is being extracted from the winze on the 200 level. At the Myrtle & Juliz mine they have commenced sinking the shaft.

NEVADA COUNTY

Champion Mining Company—The new shaft of this property at Nevada City, recently started, is some distance north of the old main one. A large hoist has been installed.

Golden Gate—The work of reopening this quartz mine at Grass Valley has commenced, with W. P. Martin as superintendent. C. A. Haub is owner of the property, which has been under lease, and he has arranged to take the lease back and work the mine.

Grass Valley Miners' Union—At Grass Valley last week, at the installation of officers of the miners' union, and the surface-workers' union, the largest organizations of the kind in the State, a feature was the absence of beer, wine or other liquor from the banquet, and this is hereafter to be the rule. At the end of this week the question of forming a State miners' union for California will be discussed, and perhaps decided.

Ideal—The new hoisting and pumping plant of this mine on Deer creek has been put in place ready to start.

Republic—At this mine, Graniteville, a new ore tramway is being built from the tunnels down to the mill.

Sterling Mining Company—Work will shortly be resumed on this mine at Willow Valley, where a promising ledge 18 in. wide was recently uncovered in the east drift.

PLACER COUNTY

Green Emigrant—Work has been commenced on this property by E. W. Edwards and J. C. Christy, who have it under bond. An engine and pump are being put in to raise water for ground sluicing.

Mayflower—R. L. Fletcher is about to buy this mine, and will work the Slope, Wasson, Blackhawk and other mines through the Mayflower tunnel.

PLUMAS COUNTY

Hafner—These 12 quartz mines and four placer claims on Rush creek, owned by Henry Hafner, of Crescent Mills, have

been sold to Henry Adams, of New London, Conn. He has a 10-stamp mill on the ground.

Droege Brothers—W. J. Droege will soon put men at work driving the lower tunnel on this property in North cañon. The mine is a large low-grade proposition, but high-grade ore shoots are occasionally found.

SISKIYOU COUNTY

Elk Creek—An Yreka company has bought an interest in this mine at Hawkinsville, and will equip it with necessary machinery.

Summit View—This mine at Oro Fino has been sold by Eubanks & Ray to W. & C. E. Dyer.

Colorado

GILPIN COUNTY

Chicago-Carr Mining Company—The shaft building and gasoline plant of machinery were destroyed by fire of unknown origin, loss being \$10,000, with no insurance. Bruce M. Myers, Central City, Colo., is manager and it is reported that the company will install electrical machinery.

War Dance—A shipment of 11 tons of ores to the Denver smelter netted over \$300 per ton to Richards & Co., who are installing a gasoline hoisting arrangement and shaft building.

Rollins Mill—The Gilpin Independence Mining Company, O. Q. Beckworth manager, Exchange building, Denver, has purchased this 25 slow-drop stamp mill in Gamble gulch, near Perigo. It is installing a 60-h.p. boiler and will remodel the mill and put in Standard concentrating tables. The mill will treat the ores from the Golden Flint mine.

Canadian Mining Company, Ltd.—New York capital is interested in the purchase of the Federal mine and mill-site in Russell district, and R. E. L. Townsend, Central City, will have the management of their interests. The purchase price is given as \$40,000.

Champion Mining and Milling Company—This company, operating in Phoenix district, near Rollinsville, is going to purchase an air compressor for the Champion mine, and several carloads of ores are being shipped to Denver for test shipments, so as to determine the best treatment for the product. S. P. Weller, Majestic building, Denver, is manager.

SAN JUAN COUNTY

Ore shipments from Silverton in March were reduced by snowslides blocking the roads and railroads and doing some damage to mills. No crude ore was sent out; the shipments, all concentrates, were: Gold King, 2075 tons; Silver Lake, 1675; Sunnyside, 150; Iowa, 100; total, 4000 tons.

Idaho

NEZ PERCE COUNTY

Hogan—Forty men have been put to work on the Hogan property in the Orogrande district. Although the mine has remained idle for the past two years, it is considered a valuable one, and is well equipped. A 30-stamp mill and a large cyaniding plant are already installed.

SHOSHONE COUNTY

Black Bear—J. H. Ehlers, of Spokane, Wash., has paid another \$10,000 on the bond which he, with his associates, holds on the Black Bear Fraction mine at Black Bear; \$60,000 has already been paid. Development work has opened the ore-shoot to a depth of 250 ft., and an adit is now being driven. Three shifts are at work.

Snowstorm—This mine at Mullan has made a contract with the Amalgamated Copper Company to ship 100 tons of ore a day to its Washoe smelter at Anaconda, Mont., and shipments will commence at once. With this additional outlet, the Snowstorm will be shipping about 400 tons a day. This adds the sixth plant to its string, the other smelters taking Snowstorm ore being the Great Falls plant of the Amalgamated company, the Trail smelter of the Canadian Consolidated, the Northport, at Northport, Wash., the Tacoma, and the Greenwood smelter, at Greenwood, B. C. The crew has been increased to over 150 men and the management is preparing still further to enlarge its output.

Indiana

CLAY COUNTY

Work in the block-coal district is now almost at a standstill. One reason for the quiet times in this field is that block coal is considered a fancy-priced fuel in the market, and is largely used for domestic purposes. Large users of coal buy cheaper grades, and at this season of the year, the demand for block coal is not great. Again, in anticipation of a strike after April 1, users of coal and dealers ordered in large quantities some time ago to tide them over in the event of a shut-down. The operators in this field say that about May 1, all the mines will begin working full time.

Kansas

ZINC-LEAD DISTRICT

The continued rains and high water have drowned out the mines at Badger, Peacock and Playter. All along Spring river and Center creek also, the mines are full of water.

Duluth—This company has taken a 40-acre lease of the Baxter Mining Company's land west of the Virginia mine at Baxter Springs. This tract is entirely surrounded by well prospected land.

Kentucky

An important deal has been completed by which a tract of 86,000 acres of coal and timber lands in Morgan and Magoffin counties will pass into possession of a syndicate consisting of I. W. Culp, Robert Fields, W. P. Quissenbury, J. W. Sanders and L. H. Shellfer. The price paid was \$285,000. The syndicate is preparing to open several coal mines on the property. It will organize under the name of the Texas-Kentucky Coal and Timber Company.

Michigan

COPPER

Ahmeek—The new 50-drill air compressor will soon be put in commission. Conditions underground at this property continue favorable and drifts to the south from the 7th level at No. 2 shaft and from the 4th level at No. 1 shaft are showing especially well. The two shafts are connected at the first five levels.

Rhode Island—The drift at the 1200-ft. level toward the Franklin Jr. property continues to show good copper-bearing ground. This is the first strike of importance made at the property and the opening on the Pewabic lode of the Franklin Jr., which adjoins it on the south tends to strengthen the possibilities of this property.

Tamarack—The drift from the old workings to the Tamarack Jr. property has been completed and will drain the water into No. 1 shaft, where bailers will be maintained.

Franklin—The Franklin Jr. has finished crosscutting, at the 23d level of the Allouez conglomerate, to a point in line with the shaft being sunk on the Pewabic lode; preparations are being made to begin raising at that point. The Pewabic lode, opened at this depth by the drift, is much softer and better results than heretofore may be obtained. As a comparison of the hardness of the rock of the two lodes it is interesting to note that a stamp shoe on the Allouez conglomerate will last only about 58 hours, while on the Pewabic amygdaloid its life is about 160 hours.

Atlantic—Good progress is being made in sinking the shaft on section 16. A great deal of trouble has been encountered in this shaft, due to the shattered and disturbed formation and it is necessary to use solid timbering throughout to protect the men from the falling rock. Sinking is going on below the 15th level. The levels are laid out on the same horizontal plane as the Baltic and are numbered accordingly. Drifting is being carried on both east and west at the 12th level and the copper-bearing formation is encountered intermittently and the formation is much disturbed. It is expected that a more settled condition will prevail with

depth, and it is with this in view that operations are being pushed. The permanent hoisting plant is ready for regular commission, having been moved up from the old workings. The hoisting engine is capable of hoisting, in a double compartment shaft, from a depth of 3000 ft. A 16-drill compressor is on the ground.

Victoria—Rumors have been current of an assessment on this stock, but such action has not been formally considered by the directors. The company is carrying on an extensive exploration campaign and continues to produce about 125,000 lb. of copper monthly. The hydraulic power plant gives excellent satisfaction. A new survey of this district has been made, and it is now believed that the lode on which Victoria is working is actually the Baltic. The Lake lode is entirely distinct and lies 1260 ft. to the north. A crosscut is advancing toward the latter on the 19th level. With its rock yielding but 12½ lb. copper per ton, Victoria can produce copper, exclusive of construction and development, for about 12c. per lb.

Missouri

ZINC-LEAD DISTRICT

Big Three—Another large cave-in occurred at the Big Three mine south of Joplin and stopped traffic on the Interurban and Frisco railways.

Connor Land—Four Webb City miners have made a rich strike on their four-lot lease on the Lima ground, southeast of Webb. The shaft is 90 ft. deep, and shows a 12-ft. face of rich lead and jack.

Lonnetta—This company has completed its 150-ton mill on its 12-acre lease on the Granby land at Chitwood, and has made a test run. The lease has been thoroughly drilled and there is a 52-ft. face of ore in the shaft.

Nortonia—This mine has made its first turn-in of 201,110 lb. of zinc ore, heading the list of Joplin producers.

Tri-City—This company is sinking a large shaft on its lease on the Weaver land northwest of Carthage. Rich drill strikes were made, and this company, composed of Davenport, Ia., Rock Island and Moline, Ill., people, is proving them with a shaft.

Wheeler Land—This land, lying on the north bank of Spring river, north of Carthage, is being prospected for the first time with a drill, by local men.

Montana

BUTTE DISTRICT

Butte & London—Development work has been suspended and the pumps have been taken out of the mine. The company did not find ore of a commercial character on the 1100-ft. level and, its treasury having become exhausted of funds, a sus-

pension became imperative. There will be no resumption until financial conditions improve and the company is able to raise money on its treasury stock. The Butte & London owns the ground on which it is operating.

Pilot-Butte—Preparations are being made to resume sinking on the Pilot claim, on which work was stopped about five weeks ago when it became impossible to obtain funds.

Ida-Montana—Work will shortly be resumed on the Ida-Montana property in the eastern section of the Butte district, and \$40,000 will be spent on new machinery. The plant will be equipped with machinery to be electrically operated, and as soon as the installation is completed sinking will be resumed. The shaft is 550 ft. deep and will be sunk to the 1200 level. At the 250 the vein was crosscut and found to be 60 ft. wide, 7 ft. of which was ore. The Ida-Montana lies just east of and adjoins the mines of the Amazon-Butte company.

Raven—Sinking has been stopped on the Raven claim. The incline shaft is 1100 ft. deep, giving a vertical depth of about 750 ft.

JEFFERSON COUNTY

Daily Property—Butte men have organized a company for the purpose of securing and operating the copper properties of the Daily brothers at Wickes. The property consists of five patented claims embracing an area of about 40 acres in what is called the Corbin district, about 50 miles northeast of Butte. The property is developed by a 340-ft. vertical shaft on the Atlas ledge, there being in all about 2000 ft. of underground work. It is the intention of the new company to sink the shaft to the 1000-ft. level.

Montana Consolidated—This company is installing a new electric plant at Basin. It is understood that an order has been placed for a Westinghouse generator and for a driving plant of Erie City engines and boilers.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Ore Shipments—Ore shipments for the week ended April 2 were: Western Ore Purchasing Company, from Rogers Syndicate, 380; Sandstorm dump, 116; Little Florence, 45; Combination Fraction, 57; Waterman lease, Sandstorm, 22; total, 620 tons. Nevada-Goldfield Reduction Works, from Jumbo, 200 tons; Daisy, 35; New Western, 158; Rogers Syndicate, 25; Cook lease, 46; Begole Syndicate, 135; miscellaneous, 38; total, 637 tons. Combination mill, 630 tons. This makes a total of 1887 tons.

Florence—The new 20-stamp mill of the parent Florence company is expected to be ready to start up in about 60 days. Not much work underground has been done pending the completion of the mill.

Goldfield Consolidated—This company is mining only ore enough to keep its Combination mill running about 90 tons per day. Development work is being pushed and when the mill is completed a record showing may be expected. The new mill is being constructed under the supervision of J. B. Fleming, consulting mechanical engineer, F. L. Bosqui, consulting metallurgist. The mill will be equipped with 100 stamps, tube mills, Frue vanners and a cyanide plant. The crusher plant for concrete is installed, and the foundations started.

Sandstorm—Renewed interest in this, the first mine located in Goldfield, has been awakened by the opening up by leasers of some very rich ore. Ten inches runs very high and the 2½ ft. beside this streak, while not bonanza, is rich enough to mine. This find was made behind the footwall of the shoot mined by Loftus & Davis, from which they extracted a large sum during the life of their lease two years ago.

ESMERALDA COUNTY—GOLD MOUNTAIN

Bonnie Claire—This mill, at Gold Mountain 35 miles south of Goldfield, has started up and is in the market for certain ores. The Garrett lease will ship ores to this mill but this will not keep the 20 stamps going; hence it will enter the market for custom ores.

NYE COUNTY—BULLFROG

Gold Bar—The mill at this mine is doing good work, with 10 stamps and a Huntington mill.

Homestake—Work on the foundations for the mill is now in progress. It will have 25 stamps, to which a concentrating plant will be added later. A double-compartment shaft will be started soon, and carried down to the 1000-ft. level.

West Extension—Another strike of rich ore has been made in the 150-ft. level.

NYE COUNTY—TONOPAH

Ore Shipments—Shipments over the Tonopah & Goldfield Railroad for the week ended April 2 were: Tonopah Extension, 150; MacNamara, 110; total 260 tons. Shipments to mills were: Tonopah Company, 3200 tons; Montana-Tonopah, 1100; Belmont, 700; Midway, 200; Jim Butler, 130; total 5330 tons.

Tonopah-Belmont—Development work continues, and a good orebody is now blocked out on the 800-ft. level.

Tonopah-Buckeye—The shaft is now down 280 ft. and is nearly all timbered. A new hoist has arrived and is being put in place.

Tonopah Company—This company has decided to sink its main shaft 400 ft., from the 900-ft. to the 1300-ft. level. Preparations are now being made. This work is considered important to the

whole camp, as it will be the deepest development in the district. In the mill the 100 stamps are at work, crushing about 3300 tons weekly.

New Mexico

SANTA FE COUNTY

Cerrillos Copper Company—This company is about to erect two concentrating mills at its mines near Cerrillos. Each will have a capacity of 100 tons per day; one will be used for zinc-lead ores and the other for copper ores.

SOCORRO COUNTY

Last Chance—At this mine in the Mogollon district the night shift has been taken off; the day shift produces enough ore for the 65-ton mill. No increased production can be made until the mill is increased. For the last two years this property has been the largest producer of gold and silver in the Territory and the new orebodies opened will enable it to maintain a steady production for years to come.

Trilby—The owners of this mine have opened from 3 to 4 ft. of mill ore in the shaft at a depth of 200 ft. This property adjoins the Gray Hawk.

South Dakota

LAWRENCE COUNTY

Blue Belle—John H. O'Brien has sold to a Chicago syndicate, headed by J. F. Bradley, the 160 acres of this claim in the Custer Peak district, and the new owners will start work at once. It is a free gold property and well developed.

Gold Eagle—President Masters and Secretary Luttrell, of Indiana, have been inspecting the property. A large free-milling gold ledge is being developed and a double-compartment shaft is to be sunk 300 ft. this spring.

Pluma—The company has asked for estimates on a 1000-ton mill, 250 stamps and cyanide annex, a shaft to be sunk 1000 feet and 1000 ft. of drift work. The Pluma company, which adjoins the Homestake, has large reserves of low-grade ore, and is prepared to expend a large sum in the development and treatment of its ore.

Custer Peak—Superintendent O'Brien authorizes the statement that the New York owners are soon to erect a small reduction plant of five stamps to treat the free-gold ore found in quantities on the property.

Wasp No. 2—Repairs to the tanks were made sooner than expected, and operations in both mine and mill have been resumed.

Ben Hur—Ore was found in three separate new ledges recently after an extensive period of prospecting.

Rowena—The main drift is in 220 ft.

and indications point to the finding of the principal ledge soon.

Fortunate—The shaft is now below the 200-ft. level. A new hoist will be erected this summer and drifting started.

PENNINGTON COUNTY

Castle Creek—Pittsburg and Colorado people have formed a syndicate to work over the old placer beds by the hydraulic method, on a large scale; work will start as soon as the machinery arrives. Options are held on more than 400 acres along the creek.

North Fork—Development shows the ledge to be widening with depth and as the orebody develops more men will be put to work on the ground near Keystone.

Utah

SALT LAKE COUNTY

Utah Consolidated—This company's report for 1907, just issued, shows net earning for the year of \$2,939,070, a decrease of \$1,667,845 from 1906. Expenses and charges were \$1,759,658; dividends, \$2,100,000; leaving a deficit of \$920,588. Surplus from previous year was \$2,451,227, leaving a balance of \$1,530,639. The products of ores mined and treated were 34,555 oz. gold, 390,296 oz. silver and 13,987,551 lb. copper.

SUMMIT COUNTY

Park City Shipments—Last week shipments amounted to 1,307,320 lb., the contributing mines being: Daly-Judge, 480,000; Silver King, 721,080; New York, 106,240 pounds.

Park City Zinc Plant—This plant will be in commission early in April. The initial capacity is 50 tons daily. It will handle middlings from the Daly-Judge mill.

WASHINGTON COUNTY

Recent gold discoveries in the north-western part of this county, in what is known as the Bull Valley mining district, are attracting considerable attention. This mineral belt is believed by many to be a continuation of that cutting through Stateline, Fay, Deer Lodge and Gold Springs. Ore containing sensational values at the surface has been found, and where development work has been done encouraging results have been obtained.

West Virginia

United States Coal and Oil Company—The stockholders have voted to reduce the capital stock from 250,000 authorized shares, par \$25, to 125,000 shares, par \$25, of which 120,000 will be outstanding. It has also been voted to authorize the issue of \$3,000,000 in 6-per cent. bonds, of which \$1,500,000 will be issued at once; also voted to increase the capital stock to 240,000 shares to provide 120,000 shares

which may be exchanged for bonds. The company is now prepared to produce 3000 tons of coal per day.

Canada

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore for the week ending April 4 were as follows: Buffalo, 62,780 lb.; Coniagas, 58,700; La Rose, 238,820; McKinley-Darragh, 80,640; Nipissing, 80,000; Nancy Helen, 60,000; O'Brien, 59,280; Provincial (Gillies Limit), 93,210; Silver Queen, 123,500; Trethewey, 182,560. Total, 1,039,530 pounds.

Chambers-Fernald—Work has been resumed by a small force in charge of Captain Jeffreys, formerly of British Columbia. The men are sinking the main shaft.

Coniagas—A connection has been made between shaft No. 2 and the main shaft at both levels. Stopping is being done on veins Nos. 2 and at the upper level. A new shaft house is in course of construction.

Crown Reserve—A party comprising the directors and principal shareholders of the mine left Toronto recently to visit the property and inspect a new vein which was discovered and which is reported to be the largest vein so far found in Cobalt.

Right of Way—Shafts Nos. 1 and 2, which are 520 ft. apart, have been connected by a drift at the 86-ft. level. Shaft No. 3 has been started on an extension of the Silver Queen vein, a contract having been let for sinking 100 ft. The vein has been found at 15 ft., but at this point has no silver content.

Silver Queen—Preparations are being made for the installation of a 12-drill compressor and as soon as the snow disappears, surface prospecting will be undertaken on an extensive scale.

Mexico

CHIHUAHUA

Chicago-Mexico Mining Company—This company has begun grading for the stamp mill on its property about 30 miles from Cusihiuriachic. The ore carries silver and lead.

Cigarrero—A large body of ore giving high assays in copper, silver and gold is reported to have been struck in this mine. The extent of the deposit has not been determined, but the body is said to contain many thousand tons.

COAHUILA

Jimulco Mining Company—The directors of this company, which owns the Jimulco copper mine, have decided to reduce the capitalization to \$1,000,000.

GUANAJUATO

Bullion Shipments—Bullion in bars was shipped to Mexico City the last week of April as follows: From the Pinguico mine, 18 bars, valued at \$25,000; from the Peregrina mine, eight bars, valued at

\$11,000; from the Nayal, two bars, valued at \$5000.

Tepeyac—New orebodies have been found in this mine and in the Cata property.

Concordia—Arrangements have been completed for handling 400 tons of ore daily.

HIDALGO

Real Del Monte—This company at Pachuca has declared its first dividend under a new management, \$100 per share on 2550 shares. The Loreto plant has been converted from the old patio process to a modern cyanide mill, and a second cyanide plant will be opened on April 25.

JALISCO

Five Mines—It is reported that a European syndicate has purchased a controlling interest in this property in the Hostotipaquillo district adjoining the Cinco Minas. The property comprises 30 pertenenencias.

OAXACA

La Fortuna—This property, in the Taviche district recently purchased by Kansas City, Mo., men is to be developed by a shaft. A hoist and pump will be installed; 18 men are at work.

Conejo Blanco—Another rich orebody is reported to have been struck in this mine in the Taviche district.

SAN LUIS POTOSI

Benito Juarez Mines Company—This company, operating at Peñon Blanco, is shipping the high-grade ore taken out in the course of development to the Aguascalientes smelting works. The last two cars shipped during the month of March netted \$3300 and \$3800 respectively. The medium-grade ores are stored, awaiting the completion of the 150-ton mill and cyanide plant now in course of erection. The Santa Eduwiges shaft is being sunk below the 125-m. level at the rate of one meter a day.

SONORA

Camanca Consolidated—An officer of the company recently denied that the smelting works would be started up in the near future. The installation of new furnaces will require several weeks, and the company does not intend to resume until it can do so upon an improved economical basis. The plant will not be ready for operation for two or three months.

VERA CRUZ

Furbero Pipe Line—About 1000 tons of material has arrived for the construction of the 6-in. pipe line to carry oil from Furbero to Tuxpam. The line is to be built by the Oil Fields of Mexico Company, will be 85 km. long and will have a capacity of about 15,000 bbl. of oil per day.

Africa

RHODESIA

Gold production in February is reported at 47,883 oz. fine, a decrease of 2838 oz. from January. For the two months ended Feb. 29 the total was 87,530 oz. in 1907, and 98,204 oz.—\$2,029,877—in 1908; an increase of 10,674 oz. this year.

Other production reported in 1908 included 14,797 oz. silver, 7 tons copper, 58 tons lead, 3 tons wolframite and 1426 tons chrome ore. Coal production from the Waukie mines was 9733 tons in February.

TRANSVAAL

Gold production in March is reported at 574,901 oz. fine, being 32,971 oz. more than in February, and 36,404 oz. more than in March, 1907. For the three months ended March 31 the total was 1,569,677 oz. in 1907, and 1,677,160 oz., or \$34,666,897, in 1908; an increase of 107,483 oz., or 7 per cent.

Asia

SIAM

According to the *Far Eastern Review*, gold is widely distributed in Siam, and is washed out of the alluvium by the natives in several districts. The chief of these are Pu Kiri, Bangtaphan, Kow Suplu and Tomoh. In the latter district Chinese workers carry on lode mining as well as alluvial. The native gold-mining industry is, however, unimportant, the total number of persons regularly employed probably not exceeding 1000. Gold mining according to modern methods has been far from successful in Siam. Many concessions have been granted by the Government, and much capital has been expended; but in no single instance have mining operations met with any success.

New Caledonia

Exports of minerals in January, as reported by the *Bulletin du Commerce*, of Noumea, were 14,252 metric tons of nickel ore, 205 tons cobalt ore and 1625 tons chrome ore.

South America

BOLIVIA

Official statistics show that the exports of *barrilla*, or black tin, were 29,374 metric tons in 1906, and 27,678 in 1907; a decrease of 1696 tons. As the *barrilla* will average 60 per cent. metallic tin, these exports were equivalent to 17,624 tons tin in 1906, and 16,607 tons last year.

BRITISH GUIANA

Gold exports for the three months ended March 31 were 9977 oz. bullion in 1907, and 7417 oz. in 1908; a decrease of 2560 oz. The bullion exported this year was equal to \$129,887, or 6284 oz. fine gold.

Metal, Mineral, Coal and Stock Markets

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

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, April 15—The first official act of President Lewis of the Mine Workers' organization, was to call a meeting of the operators of the competitive States, which was held in this city on April 6, where an agreement was entered into for the holding of an interstate wage conference between the miners and operators at Toledo, O., beginning April 14. The agreement for a renewal of the old interstate arrangement was indorsed by the operators of Indiana, Ohio and western Pennsylvania, Illinois alone holding out against the plan. The position of the Illinois operators is that they are now negotiating with their miners for district agreements and that the negotiations have progressed to a point where they believe a satisfactory agreement is assured. Consequently they propose to continue along district lines this year. Whatever conclusion is reached at Toledo will omit Illinois. The first question to be considered, probably, will be a resumption of work pending the settlement. Unless some unforeseen difficulty should arise, it is now probable that a settlement will soon be reached.

The Eastern markets, both anthracite and bituminous, are quiet, with no special change from the conditions reported last week.

COAL TRAFFIC NOTES

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to April 4, in short tons:

	1907.	1908.	Changes.
Anthracite.....	1,399,636	1,306,946	D. 92,690
Bituminous.....	9,750,220	8,780,011	D. 970,209
Coke.....	3,672,160	1,847,418	D. 1,824,742
Total.....	14,822,016	11,934,375	D. 2,887,641

The total decrease thus far this year has been 19.5 per cent.

Coal and coke tonnage, Chesapeake & Ohio Railway, eight months of fiscal year from July 1 to Feb. 29, short tons:

	Coal.	Coke.	Total.
New River.....	3,900,371	137,857	4,038,228
Kanawha.....	3,287,394	65,512	3,352,906
Kentucky.....	196,225	.....	196,225
Connecting lines.....	124,107	47,834	171,941
Total.....	7,508,097	251,203	7,759,300
Total, 1906.....	6,325,421	275,846	6,601,267

Deliveries this year to points west of mines, 3,779,971 tons coal and 166,752 coke; points east, 1,138,686 tons coal and 84,451 tons coke; tidewater, 2,570,078 tons coal.

Coal receipts at St. Louis, two months ended Feb. 29, were 1,403,830 short tons

in 1907, and 1,339,952 in 1908; decrease, 63,878 tons.

Coal tonnage, Ohio Coal Traffic Association, two months ended Feb. 29, short tons:

	1907.	1908.	Changes.
Hocking Valley.....	643,098	413,856	D. 229,242
Toledo & Ohio Cent..	304,182	175,082	D. 129,100
Baltimore & Ohio....	343,869	293,984	D. 49,885
Wheeling & L. Erie..	565,542	420,151	D. 145,391
Cleve., Lorain & Wh.	443,264	397,779	D. 45,485
Zanesville & Western	228,806	215,286	D. 13,520
Toledo Div., Pen. Co.	482,034	317,879	D. 164,155
L. Erie, Alliance & Wh.	205,593	190,226	D. 15,367
Marietta, Col. & Clev.	2,967	12,577	I. 9,610
Total.....	3,219,355	2,436,820	D. 782,535

Total decrease this year was 24.3 per cent.

Bituminous coal and coke shipments, Pennsylvania and West Virginia, two months ended Feb. 29, short tons:

	Coal.	Coke.	Total.
Balt. & Ohio.....	3,407,531	392,474	3,800,005
Buff., Roch. & Pitts.	880,733	76,806	957,539
Penn. lines, N. Y. C.	1,087,260	10,912	1,098,172
Pitts. & L. Erie.....	1,028,781	411,284	1,440,065
Norfolk & Western..	1,514,887	275,136	1,790,023
Total.....	7,919,192	1,166,612	9,085,804
Total, 1907.....	9,872,187	2,460,102	12,332,289

In addition the Baltimore & Ohio carried 206,202 tons anthracite in 1907, and 154,302 in 1908; decrease, 51,900 tons.

Coastwise shipments from chief Atlantic ports, two months ended Feb. 29, long tons:

	Anthracite.	Bitum.	Total.	PerCt.
New York....	2,519,868	1,632,937	4,152,805	63.4
Philadelphia	335,477	728,239	1,063,716	16.2
Baltimore....	29,442	620,195	649,637	9.9
Newp't News	.....	349,204	349,204	5.3
Norfolk.....	.....	340,248	340,248	5.2
Total.....	2,884,787	3,670,823	6,555,610	100.0
Total, 1907.....	2,978,422	3,242,678	6,221,100	.....

Increase this year, 334,510 tons, or 5.4 per cent. New York includes all the New York harbor shipping ports.

New York

ANTHRACITE

April 15—Prepared sizes are active and considerable coal is being absorbed. Dealers look for a heavy business during the remainder of April and possibly in May. Small steam sizes are inclined to be dull, except pea coal. Prices are as follows: Broken, \$4.25; egg, stove and chestnut, \$4.50; pea, \$3.25@3.50; buckwheat No. 1, \$2.35@2.50; buckwheat No. 2 or rice, \$1.65@2; barley, \$1.35@1.50; all f.o.b. New York harbor. The prices on steam coal are not the circular prices, but are for coal sold by independent dealers and the price depends largely upon quality.

BITUMINOUS

The soft-coal market is practically at a standstill and dealers are doing hardly

any business. A number of producers have contracted for the bulk of their year's output, but they report that the consumers are slow about ordering their first shipments.

The controversy between the mine owners and Interstate Commerce Commission has resulted in forcing the mine owners to prepay freight charges on all-rail shipments; this is not at all relished by the shippers.

In New York harbor no business is being done and good grades of steam coal may be bought for \$2.50@2.60. Transportation from mines to tide is slow, cars requiring a week to 10 days to run through. Car supply is more than sufficient. In the coastwise-vessel trade there is a scarcity of small boats, but many large vessels remain tied up and out of commission. Freight rates are as follows: To Boston, Salem and Portland, 60@65c.; to Lynn, 65@70c.; Newburyport and Portsmouth, 70@75c.; Saco, \$1; to Bangor and Bath, 75@80c.; to Gardiner, 80c.; to the Sound, 50@55c. Towages where usual.

Birmingham

Birmingham, April 13—One of the mines of the Tennessee company in the Pratt mines division has resumed operation, and others will be started up when the work of improvements at the Ensley steel plants are completed. Edward Flynn, assistant State mine inspector, is authority for the statement that the production in Alabama at the present time is about 50 per cent. off. The demand for domestic coal is holding up fairly well.

Coke is in slow demand, with no immediate prospects of picking up, as work at the furnaces is still slack.

Chicago

April 13—To all appearances the suspension of mining occurred at a fortunate time for the local market, for notwithstanding the scarcity of visible supply consuming interests refuse to buy except in small lots. Contract buying is not so general as usual at this season of the year. Open market conditions have been too favorable to the consumer.

Quotations remain about as last week, lump or egg being \$1.75@2.25, run-of-mine \$1.50@1.65 and screenings \$1.35@1.50, for such Illinois and Indiana coal as is available. Brazil block has a steady sale at \$2.60@2.75.

Eastern coals have been somewhat un-

der circular prices, smokeless selling for about \$3 run-of-mine and \$3.50 for lump. Hocking's visible supply has been about disposed of at \$2.75@3. Youghiogeny is in very small demand and supply at \$3.10 @3.20. Most users of Eastern coals are using whatever coal is available.

Indianapolis

April 14—The joint scale committee of the Indiana miners and operators held a three days' meeting in Terre Haute March 8, 9 and 10 and adjourned over until after the Toledo meeting. The miners at Linton, Oakland and Sullivan have returned to work. The most serious condition is at Linton where the miners insist that the operators yield the clause in the agreement imposing a fine of \$1 a day on each man for a stampede-strike. The operators say they will let the conference adjourn without agreement before they will yield the clause. The action of the Linton miners, in violating the agreement to continue at work, is cited as establishing the need of the restraint.

Pittsburg

April 14—Interest is centered in the joint conference of miners and operators which opens in Toledo today. Before leaving Pittsburg, operators declared they would agree to continue the old rate, based on 90c, for pick mining, provided a contract is made for a period of two years. If the miners insist on a one-year contract, the operators say they will demand a stiff reduction in the mining rate. The suspension of two weeks has exhausted the visible supply, and as none of the mines is in operation, there is no coal to be had. This, however, is not seriously affecting consumers who, in anticipation of a shut-down, laid in an ample supply and will not be in the market for at least 30 days. Quotations continue at \$1.15 for mine-run coal on contract and \$1.20 for current business.

Connellsville Coke—There is no demand and prices continue weak. Furnace coke, spot shipment, is \$1.60; on contract, \$1.80. Foundry coke is \$2.25@2.35, any delivery. The *Courier* gives production in both regions for the week at 132,418 tons. The shipments aggregated 5780 cars, distributed as follows: To Pittsburg, 1987; to points west of Connellsville, 3402; to points east of Connellsville, 391 cars.

Foreign Coal Trade

Coal bunkered, or sold to steamships in foreign trade, at United States ports for the two months ended Feb. 29 was 912,899 tons in 1907, and 972,747 tons in 1908; increase, 59,848 tons. Adding exports, previously reported, makes the total coal sold for consumption outside of the United States, for the two months, 2,362,-

351 tons in 1907, and 2,497,614 tons in 1908; increase, 135,263 tons.

Iron Trade Review

New York, April 15—The markets continue dull, and new business is irregular. The meeting last week resolved to maintain prices, and it was announced that the Steel Corporation would make no reductions. However, it is reported that some of the independent producers are making reductions to get what business is going; and these reports are generally believed, though not officially admitted. As we stated two weeks ago, a cut on billets was practically made when the makers agreed to pay all or part of the freight from the mills. In this way the price was nominally maintained. It is certain that contracts have been taken for some structural work at prices which would not be possible unless the material could be obtained at less than the nominal quotations. It is altogether probable that this cutting of prices will increase.

It is reported that negotiations are pending for the sale of the Corrigan, McKinney & Co. properties in the Lake Superior iron region to the Oliver Iron Mining Company. No confirmation of this report can be had.

Birmingham

Birmingham, April 13—The pig-iron market is still quiet, though manufacturers are hopeful. The home consumption is again falling off and is almost down to its lowest record.

The work at the steel plant at Ensley, in the way of improvements and enlargements, is being pushed and, it is expected, will be completed earlier than was anticipated.

The cast-iron pipe trade is said to be showing a little weakness again, though the two big plants at North Birmingham are in full operation, almost.

All pig iron sold nowadays in this section is in small lots. Quotations range between \$12 and \$13 per ton, No. 2 foundry.

Chicago

April 13—Sales of pig iron are still small, but inquiries for large amounts have been in the market. Quotations are not easy to give in this condition of the market, for on Northern iron especially the needs of would-be seller and would-be buyer are too diverse to permit of a stable market condition. In general Northern ranges \$1@1.50 over Southern, the basic price of which is \$12 Birmingham, or \$16.35 Chicago, with perhaps 25c. less on the most favored lots. Northern charcoal is in small but steady demand at \$20.50@21.

The coke market is still dull, with sales

small, and the best Connellsville holding at \$5 per ton.

Philadelphia

April 14—An increase in sales of pig iron is now in progress as a result of recent price adjustments, and new business is appearing in sight as a result of harmonious understandings between makers and consumers. This is about all that can be safely said. Additional pipe iron has been contracted for at Southern furnaces. More forge has been taken. Stocks are still large and furnace owners are more anxious to transform them into cash. Basic is quoted at \$17@17.50; forge, \$16@16.50; No. 2 and foundry, \$17.50@18.25.

Billets—The lines of work calling for steel billets are still slack. The manufacturers have not offered any further inducements to order.

Bars—In a retail way the market is improving.

Sheets—More business is coming to the stores and the mill owners are making inviting bids for business.

Structural Material—Some good-sized orders have been placed within a few days for distant enterprises, but little work has come from home sources. Prices are lower, but each order stands on its own basis.

Pittsburg

April 14—Market conditions continue quiet as to large orders but there is a good run of small orders going, which aggregate a large tonnage and it is believed that the situation is gradually improving. It is evident that some consumers are determined to wait for lower prices before placing big orders. The Steel Corporation and the chief independent interests are adhering strictly to the present prices, but some shading is being done in plates, structural material and light rails by concerns that are not bound by the agreement. There are rumors circulated frequently that a general reduction in all finished lines is under contemplation but they are denied by the principal steelmakers. The season's price on cotton ties is fixed at 85c. a bundle, or 10c. less than last year. It is estimated that the requirements for the season will amount to about 2,000,000 bundles, or 40,000 tons. Most of this material has already been made. The new price is the same as was in force during the seasons of 1905-06. There is nothing doing in steel rails. Tin-plate mills are run to nearly 90 per cent. of capacity and the sheet mills to about 50 per cent. The wire mills continue to operate to 65 per cent. of capacity.

Pig Iron—Many inquiries are being received but no actual business, except in small tonnages. No sales of standard bessemer, and large interests continue to quote \$17, but 25c. less can easily be done.

No. 2 foundry is quoted at \$15.50, Valley, but sales have been made at \$15.25. Basic is quoted at \$15.25; gray forge, \$14.50 at furnace.

Steel—Considerable inquiry for crude steel, but no sales; consumers are waiting for a reduction. The billetmakers continue to quote \$28, Pittsburg, for both bessemer and open-hearth billets, but pay half of the freight when it runs from \$1 to \$3 a ton. Sheet-bars continue at \$29.50, delivered; tank plate 1.70c.; merchant steel bars, 1.60c.

Sheets—There seems to be a better tone. Black sheets are quoted at 2.50c.; galvanized 3.55c., for No. 28 gage.

Ferro-Manganese—The maximum price is about \$45 per ton.

Metal Market

NEW YORK, April 15.

Gold and Silver Exports and Imports
At all U. S. Ports in March and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
Mar. 1908..	\$ 1,447,206	\$ 3,618,885	Imp. \$2,171,679
" 1907..	2,126,173	5,046,243	" 2,920,070
Year 1908..	3,859,003	17,398,551	" 13,539,548
" 1907..	5,703,304	11,646,615	" 5,943,317
Silver:			
Mar. 1908..	4,329,369	3,723,307	Exp. \$606,062
" 1907..	5,058,461	4,006,497	" 1,051,964
Year 1908..	12,586,257	10,796,986	" 1,791,271
" 1907..	14,669,396	11,385,526	" 3,283,870

Exports from the port of New York, week ended April 11: Gold, \$30,000, to Haiti; silver, \$831,195, chiefly to London. Imports: Gold, \$70,117, from the West Indies and Mexico; silver, \$39,235, from Central and South America.

Specie holdings of the leading banks of the world April 11 are reported, as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York			\$287,144,600
England.....	\$193,404,950		193,404,950
France.....	555,205,550	\$180,502,030	735,707,580
Germany.....	153,105,000	63,450,000	216,555,000
Spain.....	77,600,000	131,010,000	208,610,000
Netherlands....	38,479,500	21,586,500	60,066,000
Belgium.....	20,790,000	10,395,000	31,185,000
Italy.....	182,000,000	22,400,000	204,400,000
Russia.....	565,185,000	34,710,000	599,895,000
Aust.-Hungary.	232,105,000	65,050,000	297,155,000
Sweden.....	19,490,000		19,490,000
Norway.....	7,440,000		7,440,000
Switzerland....	16,770,000		16,770,000

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

Silver Market

SILVER AND STERLING EXCHANGE.							
Apr.	Sterling Exchange.	Silver.		Apr.	Sterling Exchange.	Silver.	
		New York, Cents.	London, Pence.			New York, Cents.	London, Pence.
9	4.8655	54 3/4	25 3/8	13	4.8685	54 3/4	25 3/8
10	4.8665	54 3/4	25 3/8	14	4.8700	54 3/4	25 3/8
11	4.8675	54 3/4	25 3/8	15	4.8715	55	25 3/8

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

Messrs Pixley & Abell report silver shipments from London to the East for the year to April 2:

	1907.	1908.	Changes.
India.....	£4,043,558	£1,941,438	D. £2,102,120
China.....	.....	501,400	I. 501,400
Straits.....	172,550	78,270	D. 94,280
Total.....	£4,216,108	£2,521,108	D. £1,695,000

Imports for the week, £4000 from Australia and £199,000 from New York; £203,000 in all. Exports, £188,200 to India.

Other Metals

Apr.	Copper.			Tin.	Lead.	Spelter.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.			New York, Cts. per lb.	St. Louis, Cts. per lb.
9	12 3/4 @13 1/2	12 3/4 @12 3/4	58 1/2	32	3.90 @4.00	4.60 @4.65	4.45 @4.50
10	12 3/4 @13	12 3/4 @12 3/4	57 3/4	31 3/4	3.95 @4.00	4.60 @4.65	4.45 @4.50
11	12 3/4 @13	12 3/4 @12 3/4	.....	31 3/4	3.95 @4.00	4.60 @4.65	4.45 @4.50
13	12 3/4 @13	12 3/4 @12 3/4	58	31 3/4	3.97 1/2 @4.00	4.60 @4.65	4.45 @4.50
14	12 3/4 @13	12 3/4 @12 3/4	57 3/4	31 3/4	3.97 1/2 @4.00	4.60 @4.65	4.45 @4.50
15	12 3/4 @13	12 3/4 @12 3/4	58 3/4	31 3/4	3.97 1/2 @4.00	4.60 @4.65	4.45 @4.50

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

New York Metal Exchange—At the first meeting of the newly-elected directors of the Metal Exchange, held April 9, the copper quotation committee was enlarged from three to four. The committee for the next year is composed of Berthold Hochschild, Paul Koning, L. Vogelstein and Harmon W. Hendricks. The committee on tin is composed of Messrs. Koning, Baerwaid, Hall and Groves. Lead—Messrs. Hochschild, Steiner and Langloth. Spelter—Messrs. Vogelstein, Hochschild and Elkan.

Copper—After holding its metal above the market for about a fortnight, the largest selling interest on Friday last sought to secure some of the business that had been going to other sellers and reduced its price to 13c., delivered 30 days. This led immediately to further reductions by all of the independent sellers, and competition being keen, lower prices have since been accepted. The market for Lake copper has been slow and quotations more or less nominal, but in electrolytic the business transacted has been of fair volume, particularly for the home trade. Domestic consumers have shown a great deal more interest than for some weeks past, and it is reported that they have taken some large orders which justified in turn the purchase of copper on their part on a more liberal scale. Europe so far has proved indifferent to the developments on this side, but toward the end of the week a stronger tendency is making itself felt there, which, however, has not yet extended beyond the speculative markets. At the close Lake copper is

quoted at 12 3/4 @13c.; electrolytic in ingots, cakes and wirebars at 12 5/8 @12 3/4c. The average of this week at which business in casting copper has been quoted is 12 3/8 @12 1/2 cents.

The standard market was reactionary throughout the week, until the very close, when covering by bears and buying by bull interests brought about an advance, but the close is below last week's quotations, being cabled as £58 7s. 6d. for spot, £58 17s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £61 10s. @62 10; best selected, £62 @62 10; strong sheets, £73 @74.

The report is reiterated that the American Smelting and Refining Company will not renew its contract, soon to expire, with the United Metals Selling Company for the sale of copper. Subsidiary companies of the smelting company have been selling independently for some time past.

Tin—The London market has undergone daily fluctuations, though retaining in the main its strong undertone. The close is cabled at £144 10s. for spot, £143 5s. for three months.

The consumptive demand in this market has been fairly satisfactory, and most of the tin which is now being imported is going right into consumption. Business is being done on a satisfactory scale, and prices remain firm at the close at from 31 3/4 @32c. per pond.

Lead—There is a great deal more activity, and the quantities in second hands, and particularly Missouri lead, which for some time past was obtainable at a discount, have found a market, and in consequence prices have hardened, the close being quoted at 3.97 1/2 @4c. New York.

The London market is neglected, and under light offerings declined to £13 11s. 3d. for Spanish lead, £13 13s. 9d. for English lead.

Spelter—Although a great many of the smelters are unwilling to meet the present market, the demand is of such small proportions that the quantities which are available from day to day can only be placed with difficulty. The close is barely steady at 4.60 @4.65c. New York, 4.45 @4.50c. St. Louis.

The European market has eased off somewhat, the close being cabled at £21 5s. for good ordinaries, £21 10s. for specials.

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

Antimony—Some large orders for future delivery were placed last week, resulting in a firm market. Quotations advanced to 9 @9 1/4c. for Cookson's, 8 1/2 @8 3/4c. for Hallett's, and 8 1/4 @8 1/2 for ordinary brands.

Platinum—Little business is being done. A reduction of 50c. per troy ounce was made during the week. Prices are: \$26 for hard platinum, \$23.50 for ordinary, and \$16 for scrap.

Aluminum—While the American producer still quotes 33c. for No. 1 ingot, it is stated that European producers are offering to accept large orders for American delivery at 30c. Rods and wire, 38c.; sheet, 40c. base.

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

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

Quicksilver—New York, \$45 per flask; San Francisco, \$44.50@45.50, domestic; \$43@44, export; London, £8 5s.; Is. 3d. less from second hands.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, two months ended Feb. 29; figures in long tons, except quicksilver, which is in pounds:

Copper:	Imports.	Exports.	Balance.
Copper ore.....	18,129	.....	.....
Matte and precipitate.....	13,229	.....	.....
Fine copper.....	14,110	.....	.....
Total copper.....	22,538	8,734	Imp. 13,804
Total, 1907.....	20,573	8,556	Imp. 12,017
Tin:			
Straits.....	5,339	.....	.....
Other.....	1,327	.....	.....
Total.....	6,666	5,264	Imp. 1,402
Total, 1907.....	6,958	4,624	Imp. 2,334
Lead:			
United States.....	6,538	.....	.....
Spain.....	16,118	.....	.....
Other.....	15,697	.....	.....
Total.....	38,353	9,589	Imp. 28,764
Total, 1907.....	32,044	8,880	Imp. 23,164
Spelter:			
Spelter.....	13,083	.....	.....
Zinc sheets, etc.....	2,814	.....	.....
Total.....	15,897	1,096	Imp. 14,801
Total, 1907.....	17,437	654	Imp. 16,783
Quicksilver, lb.....	821,650	476,021	Imp. 345,629
Quicksilver, 1907.....	797,122	567,430	Imp. 229,692

Copper totals give estimated contents of all material in fine copper. Tin-ore imports, not given above, were 2775 tons in 1907 and 3665 tons this year. Imports of iron and copper pyrites, 135,179 tons in 1907, and 168,036 in 1908; increase, 32,857 tons.

Missouri Ore Market

Joplin, Mo., April 11—The highest zinc price was \$39.50, on a base price ranging from \$36 to \$34 per ton of 60-per cent. zinc, all grades averaging \$33.52 per ton. The highest price paid for lead was \$55 per ton, an increase of \$1. Medium grades brought \$52@54, and all grades averaged \$51.98 per ton.

On top of the close purchasing of the reserve stock, which has been progressing the past four weeks, the district has undergone seven days steady downpour of rain, ending last night, and the streams are all out of their banks. Some mines have been inundated, but so far the larger ones have been protected by the dikes thrown up two years ago. This situation brought a strong and advancing market.

Following are the shipments of zinc and lead from the district for the week ending April 11:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	2,921,080	829,050	\$71,113
Joplin.....	2,115,940	291,050	44,594
Galena.....	863,840	142,330	18,184
Duenweg.....	426,640	37,870	8,236
Prosperity.....	417,750	41,030	8,168
Carthage.....	286,210	.....	5,294
Aurora.....	354,410	8,400	5,277
Alba-Neck.....	276,160	.....	5,108
Badger.....	151,950	.....	2,657
Granby.....	185,000	17,000	2,200
Sarcoie.....	127,170	.....	2,161
Quapaw-Baxter.....	121,310	.....	2,062
Spurgeon.....	450,500	15,470	2,057
Wentworth.....	92,500	.....	1,138
Carl Junction.....	48,790	4,200	988
Totals.....	8,539,250	1,386,400	\$179,187

15 weeks.....130,400,800 18,772,810 \$2,725,801
Zinc value, the week, \$143,149; 15 weeks, \$2,261,784
Lead value, the week, 36,038; 15 weeks, 464,017

Average ore prices in the Joplin market were, by months:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1907.	1908.	Month.	1907.	1908.
January...	45.84	35.56	January...	83.58	46.88
February...	47.11	34.92	February...	84.58	49.72
March.....	48.66	34.19	March.....	82.75	49.90
April.....	48.24	.....	April.....	79.76	.....
May.....	45.98	.....	May.....	79.56	.....
June.....	44.82	.....	June.....	73.66	.....
July.....	45.79	.....	July.....	58.18	.....
August.....	43.22	.....	August.....	59.54	.....
September.....	40.11	.....	September.....	53.52	.....
October.....	39.83	.....	October.....	51.40	.....
November.....	35.19	.....	November.....	43.40	.....
December.....	30.87	.....	December.....	37.71	.....
Year.....	43.68	.....	Year.....	68.90	.....

Wisconsin Ore Market

Platteville, Wis., April 11—The highest price paid this week for zinc ore was \$37.50 per ton on a basis of \$35 to \$36.50 for 60-per cent. zinc. The price of lead ore remains unchanged at \$25 per thousand for 80-per cent. lead.

Shipments for week ended April 11 were:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Benton.....	464,480	62,390	.....
Galena.....	176,000	.....	.....
Hazel Green.....	164,800	.....	.....
Platteville.....	160,500	.....	.....
Livingston.....	90,000	.....	.....
Elmo.....	86,100	.....	.....
Rewey.....	64,700	.....	.....
Total.....	1,206,580	62,390	.....
Year to Apr. 11.....	18,541,350	1,149,675	79,800

Dubuque, Iowa, shipped 230,000 lb. zinc ore during the month of March, not heretofore reported. Owing to the condition of the wires no reports could be secured this week from Harker, Linden and Highland, but these will be included in next week's report.

Chemicals

New York, April 15—The demand for heavy chemicals has been light.

Copper Sulphate—The demand is active both for spot and future deliveries. Supplies are not over-abundant and the market shows strength. Prices remain un-

changed at \$5 per 100 lb. for carloads and \$5.25 for smaller lots.

Nitrate of Soda—The demand is fairly good, but prices have declined. Quotations now are 2.35c. for spot delivery and 2.30c. for other positions of 1908; 2.35 for 1909; and 2.32½c. for 1910. The 96-per cent. grade sells 5c. per 100 lb. higher.

Phosphate Rock—According to J. M. Lang & Co., 9226 tons of phosphate rock were shipped through the port of Savannah in March; 7040 tons went to Germany and the remainder to Austria and England. Paul C. Trenholm reports 5435 tons of phosphate rock shipped by rail from Charleston, S. C., in March.

Mining Stocks

New York, April 15—The stock markets continue largely professional, with apparent firmness. Prices have been generally maintained, but dealings have been light. There has been little or nothing to affect conditions in either direction.

In the curb market there has been more trading in the copper shares, which have been stronger, as a rule. The Nevada gold stocks have been rather neglected, but prices fairly maintained on the lighter trading.

Boston

April 14—The market has been a seesaw one for mining shares the past week, with a lower range of prices prevailing to-night. Boston Consolidated still remains a mystery, falling to \$10.37½ today, with some recovery from this point. There is ground for belief that the Guggenheims would like to have this property, and the depression in the stock is due to this fact.

Amalgamated went off \$3 to \$56.75, recovering \$1 tonight. Butte Coalition is off \$1.25 to \$19.75. Copper Range, \$1.75 to \$63.87½, and North Butte ran off \$2.50 to \$51.50, with \$1 recovery.

Bingham Consolidated fell back again. The plan of reorganization has been opposed by a fair-sized minority interest. United States Smelting and Refining is said to have materially reduced a floating debt carried through the financial stringency by the sale of bullion. There is likelihood of a contest for control of this company at the annual meeting, May 20.

The curb has not brought any features of moment.

San Francisco

April 8—The San Francisco Mining Exchange, which was organized about a year ago, as a sort of opposition concern to the old San Francisco Stock and Exchange Board, has quit business. It was a successor to the San Francisco & Tonopah Mining Exchange, which was established during the Tonopah excitement. The directors have been trying to prevent

