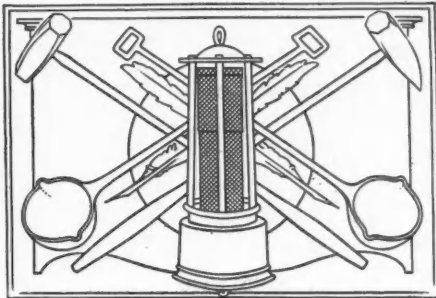


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The Senseless Scare

The markets of the East are submerged by a wave of pessimism. Bankers, brokers, and especially investors, seem to be scared out of their wits. What excites their fear is unknown even to them. They are terrified by spooks that they think may exist, but whereof they do not know the nature or the manifestation. One specter at least has been laid, namely the prospect of labor troubles anticipated on April 1, the day of the proletariat. Of this there was never much danger. The times are not propitious for strikes.

The most dreadful specter is doubtless the coming decision in the monopoly cases. If adverse, the "big fellows" are going to precipitate a panic, and out of revenge depreciate the value of their own property, etc., *ad nauseam*, and also bosh. The Supreme Court of the United States is composed of conservative jurists, who are also patriots. It is senseless to believe that they will destroy the foundations of our industrial structure and relegate our business to barbarism and chaos. James J. Hill talked sanely upon this subject.

Another spook is recession in business. With wise shakings of the head, it is said that the clock has struck 12. This is the evil effect of the blowing of bubbles in the latter part of 1909, and is the aftermath of the "sunshine movement," which persuaded folks in 1909 that a boom had come once more. There was none.

We had two years of industrial depression. During that time but little new work was inaugurated; maintenance was neglected. But the population and its

needs kept on increasing, and must be supplied. Railway facilities are notoriously inadequate and must be increased. The wear of existing plants must be made good. The improvement in business in 1909 did not become noteworthy until after mid-summer. It is inconceivable that in the brief period of the remainder of that year the deferred development of two years was consummated. It is yet to be done, and this means industrial activity. In fact, the consumption of raw material is increasing steadily. The pessimists ought to go West and witness the population there buying and selling and making money without thought of calamities.

The world is never free from evils. There are some now. One of them is extravagance. Another is the greed that accompanies prosperity and manifests itself in the financing of accumulations to extract from consumers the last penny they will pay. The status of our foreign trade, resulting from these factors, is detrimental to welfare, but this will be corrected. Producers all want to sell freely, but conditions must be adjusted so that consumers will buy freely. The present tendency to readjust prices is wholesome.

In the metal industries this readjustment has already made good headway. Our index number for February was 124 against 127 for January and 101 as the average for 1909. In copper there was no large decline, but that metal has not lately had any rise worth mentioning. Copper is now the center of pessimism. The "talent" regards it as hopeless; can't see anything that will lift it out of the slough of despair. About a year ago the

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same prophets were talking about the speedy coming of a 15c. market. The fact that the accumulation was then increasing cut no figure in their estimation. Now that it is decreasing, the prophets are hopeless.

The present wave of pessimism is not likely to last long. Such senseless fright may end in a day.

The Collapse of Granby

As a bolt from a clear sky came last week a decline in Granby shares from \$80 to \$65, and later in the day an official statement that a report upon the property is soon to be issued, but in advance of that "it may be said that it will be disappointing as to the tonnage of ore available for stoping, which will probably not exceed 6,000,000 tons." This was received by the stockholders of the company with consternation. Not only they, but also the industry in general, had become imbued with the belief that in quantity of ore Granby was of the order of a Rio Tinto, that exhaustion of ore reserves was not a subject for serious consideration inside of a generation, that the only problem of Granby was to enlarge sufficiently its means of mining and smelting and treat an immense tonnage of low-grade ore. Even in the week of the collapse fell due the last payment upon the subscription of a new issue of stock to pay in part for increasing the company's plant and working capital.

Granby stock has never been a speculative shuttlecock. Its board of directors comprises names as honorable as the best in American industry. The directors themselves are the largest stockholders. Outside of them the stock is distributed among the best class of investors. An unusually large percentage of them seem to have been men well versed in mining. Most of them have held the stock for its dividends, rather than with any idea of reaping a profit from manipulated rises and falls. They have felt sure of their principal. There has been nothing in the recent reports of the company to excite fear; certainly nothing to arouse suspicion of the nature of the news that was abruptly told last week.

Reading between the lines of the official statement it is evident that in connection with a change in the superinten-

dency of the property, announced a few weeks ago, the president, with a consulting mining engineer, was led to visit British Columbia and while there learned of facts which previously they did not know. Upon their return to New York a report was in preparation for communication to the stockholders. However, the bad news apparently leaked out prematurely, which does not necessarily imply that it escaped from the office of the company. In the alarm naturally caused by the violent break in the stock and the circulation of wild rumors, the management seems to have thought it best to tell the truth promptly.

In this, at least, its action stands in a favorable light when compared with that of some other managements which have maintained mystery respecting the real condition of their mines when adversity has come. The truth may be unpalatable but it is better to know it than to be buffeted and worried by uncertainty.

Harsh things are naturally being said about the slump in Granby. In the company's report for fiscal year ending June 30, 1909, A. B. W. Hodges, the superintendent, said: "Our ore reserves are largely increased and we have ore in sight for many years to come." In its statement to the Stock Exchange, March 16, 1910, the company said that "approximately 8 to 10 million tons of ore are now developed ready for extraction in the company's territory." The discrepancy between these statements and that of March 23 clearly demands the explanation which has been promised.

There are some officers and directors of the company whose names have particularly inspired confidence. No one will believe, we think, that such men as Higginson, James, Langeloth and Nichols, besides others of this board, have intentionally lent themselves to any deception. We feel sure that they will make a frank declaration respecting the whole matter, which is, indeed, one that cannot be dismissed lightly. No event in years has done so much to destroy public confidence in mining investments, and the Granby stockholders have reason for their indignation, wherever be the responsibility. If there has been treachery by anyone in any manner, the guilty should be branded, but until all the facts are known, judgment must be deferred.

Production of Spelter in 1909

Our final statistics of the production of spelter in 1909 do not differ materially from the preliminary figures that we reported Jan. 8, the difference being less than 0.25 per cent. The revised figures are given in the following table:

PRODUCTION OF SPELTER. (IN TONS OF 2000 LB.)		
State.	1908.	1909.
Colorado	3,079	6,115
Illinois	50,244	75,229
Kansas	99,136	103,390
Missouri	10,196	8,418
Oklahoma	14,867	28,840
South and East.....	32,989	44,470
Total	210,511	266,462

The above statistics represent the production of what is called virgin spelter, i.e., metal derived directly from ore, but an insignificant part came from galvanizers' dross treated by concerns whose business is chiefly the smelting of ore.

The deliveries for consumption are computed in the following table:

DELIVERIES INTO CONSUMPTION. (IN TONS OF 2000 LB.)		
	1908.	1909.
Stock January 1.....	32,883	25,000
Production	210,511	266,462
Imports	881	9,670
Total supply.....	244,275	301,132
Exports	2,640	2,566
Stocks, December 31.....	25,000	11,500
Deliveries	216,635	287,066

It is well known that the actual consumption was materially less than the deliveries, the surplus having been accumulated in the yards of manufacturers and possibly to some extent in storage warehouses. The reports of stocks by the smelters included not only their own metal, but also all that they were holding for other accounts.

What Is the Matter with the Metal Markets?

Since Jan. 1 there has been a decline in the prices for all of the metals except tin and aluminum. Bessemer pig iron averaged \$19.90 in January and \$18.96 in February. For the other metals the averages were, respectively, as follows: Copper, 13.62 and 13.33; lead, 4.70 and 4.61; spelter, 5.95 and 5.42; silver, 52.38 and 51.53. In March, copper fell to 13 $\frac{1}{8}$, and lead to 4.37 $\frac{1}{2}$. Producers have expressed discouragement because of this downward trend, and have asked what is the matter with the metal markets?

The answer is simple. The producers are able to output abundantly and profit-

ably at present prices. In iron, copper and spelter, the pace was set too fast in the latter half of 1909, and the prices for iron and spelter in particular were carried too high. Copper was unable to rise because of the accumulation that is being financed and lead escaped any serious inflation because of the conditions under which it is chiefly marketed.

However, much as producers would like to have 15c. copper, 6c. spelter and 5c. lead, they ought not to complain grievously over the present prices, which after all are not greatly below the averages or what ought reasonably to be expected. No one is justified in basing calculations on copper at higher than 13½c., spelter at 5.50, and lead at 4.50, and it is best to make up the mind to those figures, taking joyfully whatever in excess may be realized from time to time.

As to silver, the Cinderella of metals, will any fairy prince of commerce appear to take it away from its position of neglect? Of no great use in the arts, or esteem as an ornament, its chief purpose is to fill the demand of Asia, and produced so largely as an inevitable product, the development of a new Cobalt may at any time demoralize the market. Anyway, the course of silver is something that no one ventures to forecast.

Australasian Gold Production

We have now the full returns for 1909 of the six States of Australia and the Dominion of New Zealand. These are given in the accompanying table in fine ounces; the Northern Territory being included in South Australia. Comparison is made with the complete returns for the preceding year:

	1908.	1909.	Changes.
West'n Australia	1,647,911	1,595,263	D. 52,648
Victoria.....	870,910	654,222	D. 216,688
Queensland.....	465,085	450,937	D. 14,148
New South Wales	224,792	204,709	D. 20,083
Tasmania.....	57,085	44,689	D. 12,416
South Australia..	9,162	8,187	D. 975
Commonwe'lth	3,074,945	2,957,987	D. 116,958
New Zealand....	471,967	472,476	I. 509
Total, oz.....	3,546,912	3,430,463	D. 116,449
Total value....	\$73,314,671	\$70,907,670	D.\$2,407,001

The decline in Australian gold output has now been continuous since 1904. It is due to a variety of causes, among which is the fact that no new districts of any importance have been discovered or opened. There has been for several years comparatively little prospecting or opening of new mines. The energies of mine

operators have been diverted to other metals, notably copper; and gold mining has attracted less attention than formerly.

Western Australia remains the chief gold producer in the Commonwealth, and its output has fallen off mainly because of the lower grade of the ores found in some of its larger mines. New Zealand shows a small increase, which is the result of the working of the Waihi and two or three other important mines; its dredging industry is decreasing.

Utah Copper Company

The Utah Copper Company in 1909 produced 51,749,233 lb. of copper at a profit of 4.173c. per lb. The average price received for the copper having been 12.915c., the cost of production was 8.742c. per lb., the copper being credited with the receipts from gold and silver and all miscellaneous receipts. In its recent statement to the New York Stock Exchange the company reports that it is now producing at the rate of approximately 60,000,000 lb. per annum at a cost of 8.5c. per lb.

The report of the company does not state the tonnage of ore mined and milled, but we shall not be far wrong if we take it at 2,600,000 tons. Upon that assumption the cost of mining, mine development and stripping was 97c. per ton. The charge for stripping—\$133,713.55—is evidently about 5c. per ton of entire output, but, of course, is properly debited only to the ore extracted by open work. The proportion of ore thus extracted is not stated, which, of course, is in no way a reflection upon the company in a purely financial report of this character. It is of interest, however, to note that among its assets, Dec. 31, 1909, the company carries the item \$1,513,946.73 for advance stripping, which it states will be gradually extinguished as the ore stripped is mined in the future.

Freight on ore—\$762,080.59—appears to have been about 29.3c. per ton. There is the large item of \$1,779,866 for "treatment and refining." If we reckon that smelting, transportation of blister copper and refining cost 1.5c. per lb. of copper, there would remain \$1,003,648, or about 38.5c. per ton, for milling. These deductions are probably not far out of the way.

The Chinese in the Transvaal

The mine-labor return for the Transvaal mines in February is notable because for the first time in nearly six years no Chinese are included. The introduction of the Chinaman into South Africa began early in 1904, when the mine operators found themselves prevented from further expansion by the scarcity of unskilled labor, and obtained permission to import men from China, which seemed the only available source of supply. In July, 1904, there were 1388 Chinamen at work, and thereafter the number grew rapidly; in July, 1905, there were 43,191; in July, 1906, there were 52,234, and in January, 1907, it was 53,856, the maximum reached.

While the Chinese served the purpose of the mining companies for the time and proved fair mine laborers, their presence was resented by the white members of the community. Many believed the presence of so large an alien element to be undesirable; moreover, among so large a number of coolies there were naturally some bad men who escaped from the mine compounds and made themselves a danger which had to be dealt with by summary methods. This increased the feeling against them, and when the Transvaal became a self-governing colony, almost the first act of its parliament was to pass a law prohibiting further importations and providing that those in the country should be sent back to China as fast as their contract terms of service should expire. At first this repatriation was slow; in the first six months the number at work was reduced only to 51,472. Thereafter the movement proceeded rapidly, the total falling by successive half-yearly periods to 33,849, to 19,071, to 11,534, to 5360. On Jan. 1, 1909, only 1094 were left, and on Feb. 1 even these were gone.

Fortunately for the mine operators, conditions in South Africa have been such that it has been possible to increase the black laborers from 103,000 to over 190,000 in February of this year.

There is no place here to discuss the economic or sociological sides of the Chinese question. It is enough to note that the orderly introduction of nearly 55,000 alien laborers, and their removal without friction or disturbance, constitute a remarkable industrial episode.

CORRESPONDENCE and DISCUSSION

Views, Suggestions
and Experiences of Readers

Why Prospecting Is on the Wane in Colorado

There can be no denial of the present ore shortage in Colorado compared with former years, and the consequent dismantling of some furnaces, and running at half capacity of the others. What is the reason? One of them is apparent enough.

Looking back over 30 years of mining in Colorado, the behavior of each of the mines in the great camps of the State—Leadville, Cripple Creek, Creede, Central City and Black Hawk, Aspen, Georgetown, Red Mountain, Rico, Summitville and others—reminds one of a pan of fresh milk, where the richest is on the top, and now the cream having all been taken off, i. e., the oxidized ores and ores of secondary enrichment, we are down to the humdrum, though more regular and steady, production of the skim milk, i. e., the lower grade, but more evenly distributed baser sulphide ores.

I can remember in Red Mountain, in the San Juan region, where a carload of ore from the Yankee Girl brought \$80,000; when two carloads from the Isabella, in Cripple creek, brought \$315,000; and when in the Independence mine, at one time, they had 10 ft. wide of \$90 gold ore; when the Wheel of Fortune, in the Sneffels district near Ouray, was shipping 24-oz. gold ore, besides rich silver contents, to Green's smeltery at Silverton at a cost of \$35 for packing and \$45 for treatment; one year, when Leadville produced \$18,000,000 worth of ore.

But why are not new pans, with their cream on top, being discovered? Does anyone suppose that all have been discovered and that in Colorado the prospector has no new worlds to conquer, no more rich mines to discover? If so, it is a grand mistake; not one one-thousandth part of the State has been so prospected and exploited as to enable it to be said that all the mines have been discovered. I remember the time when every city, town and village in the State had its little groups of business men who clubbed together, or its individuals who grubstaked and outfitted their prospector to look for mines in various parts of Colorado, and when any successful miner who had made a stake forthwith invested some of his winnings in the same manner; and the result was the discovery of great mines and the resultant phenomenally rich camps above mentioned. This has all ceased. Prospectors are still being grubstaked, and going out on their

own hook, but to Mexico, Nevada, Utah, Alaska, and even to South Africa, the Philippines and other foreign countries—and why?

I will give the answer of the mining fraternity of this State as they look at it, and as they believe it, and as voiced by Hon. Edward T. Taylor, of Colorado, in his speech on "Federal Encroachments upon the Rights of the West" in the House of Representatives on Feb. 1, 1910. His words were:

"We want the impracticable restrictions removed from prospecting, and the inauguration of such regulations as will allow the development of our mining resources. Prospecting has practically ceased within the State of Colorado; there have been no more new Creedes or Cripple Creeks, or other important mining camps developed since the public domain was taken possession of by the Forest Service.

"We will heartily welcome such laws as will prevent land grabbers of every kind. We are more opposed than anyone else can be to the spoliation or monopoly of any of our immensely valuable resources. We want our timber conserved, not monopolized, and a government monopoly is not much better than any other.

"If the bills are prepared by men who know the conditions of our country, and are drafted in the interest of the growth and development of the West instead of its exploitation, I care not how strict the requirements may be for guarding against frauds of every kind. But we insist upon what we believe to be our rights, that this property shall lawfully and orderly, and as speedily as may be reasonably possible, all go into private ownership, and become the property of the residents of the States within which it is situated, and subject to taxation for the benefit of the States and counties therein. We believe that to be an inviolable right, and in every respect in accordance with the policy that has made this nation what it is. We ask for nothing more and we expect nothing less. Even though it were not a violation of our rights, we do not believe it either practical or good policy for this Government to embark in the coal business, or the oil business, or the gas, or water-power, or mining, or any other such business within our borders."

There can be no new ore production from these mountains without the discovery of new mines and new camps, and there will be none of these until the prospector, with his burro, carrying his pick

and his frying pan and grub and blankets, begins to climb the trails again. When this will be, who shall say? But I have given one of the chief reasons of the ore shortage in Colorado.

WILLIAM WESTON.

Denver, Colo., March 17, 1910.

Spurious Potassium Cyanide

The sale of the Daly Reduction Company's properties soon after the completion of the cyanide tests reported under the above heading in the JOURNAL, Oct. 23, 1909, prevented further investigation at the time and renders me unable at present to answer some of the points raised by W. J. Sharwood in his excellent article in the JOURNAL, March 19, 1910, under the heading, "Commercial Sodium and Potassium Cyanide."

Both he and E. M. Hamilton, JOURNAL, Feb. 12, 1910, are justified in criticizing the manner of reporting percentages of sodium and potassium present. Determinations were made for sodium, potassium and soluble sulphides only; percentages of the oxides of both bases were reported in terms of their cyanide equivalents, with a favorable chance of accuracy in the case of potassium.

But, as was stated at the time, the reason for writing the original article of Oct. 23, 1909, was a desire to place before metallurgists without delay this apparently fraudulent practice of manufacturers in selling highly adulterated potassium cyanide as the commercially pure article. Some chemists might know of this, but it was likely that the majority did not. All chemical questions as to ultimate composition, solvent power or precipitation efficiency were left in abeyance and certain queries were propounded in forms that were thought best calculated to start a valuable discussion of the metallurgical and commercial factors involved.

In a private communication of recent date, Abbot A. Hanks, the San Francisco analyst to whom our controls were submitted, says: "I have no present doubt but that the potassium was all combined as potassium cyanide; that enough sodium cyanide had been added to bring the salt up to the requirements, 98 to 99 per cent. (apparent) KCN, and that the remainder is some cheaper sodium salt, very probably caustic soda, added by the manufacturers as an adulterant."

From this it would appear that Messrs. Hanks, Hamilton and Sharwood are of one mind upon the subject of wholesale

adulteration; but before drawing definite conclusions as to the effect of these adulterants in metallurgical work, or before attempting an explanation of the diametrically opposite results produced by apparently identical salts upon practically identical ores, we must necessarily await the result of a much more extended research.

F. A. ROSS.

Spokane, Wash., March 25, 1910.

Gold in the Adirondacks

Supplementing the article under the above heading in the JOURNAL of March 19, 1910, the following may be of interest: About four or five years ago I was asked to investigate certain statements concerning the so-called gold-bearing sands of the Adirondack region. These statements were similar to those made in the letters of Mr. Hatmaker, published in the article above referred to, to the effect that the gold was lost in the fire assay, but that it could be recovered by amalgamation, or possibly by some wet (chemical) process. The lands in question were, if I recall rightly, in St. Lawrence county, and I do not think either Mr. Hatmaker, Professor Locke or Doctor Keith were connected with the project. The promoters were quite uncertain as to the possibility of recovering the gold by any wet (chemical) process, but were positive about the results obtained by amalgamation.

METHOD OF TESTING

Upon asking for proof, I was introduced to some of the promoters and owners, and was assured that fullest opportunity would be given for investigation and verification of their claims and of the results of tests. Preferring first to investigate the claims as to the character of the sand and its gold contents, I visited the offices where demonstrations were made. It was explained that no satisfactory recovery could be made without fine grinding, and this consisted in grinding the sand in a mortar to 80 or 100 mesh. The samples contained much sand that was of 40- and 20-mesh size. After being ground and screened through an 80- or 100-mesh sieve, one pound of the sand was taken, and sufficient water added to make it of the consistency of mortar. A "small quantity of alkali," sodium or potassium carbonate, was added "to correct or neutralize acidity."

The mass was then thoroughly stirred for 10 or 12 minutes in a large Wedgewood mortar or porcelain evaporating dish. Four ounces of mercury were added, and the mass kneaded for one hour or more, or until the mercury was so thoroughly floured that no globules were readily visible to the naked eye. Sometimes two hours were consumed in this work. Water was added in quantity, and the sand panned; the mercury was

collected, and the tailings caught and panned to collect any mercury lost in the first panning. The mercury was then carefully cleaned, washed and dried by absorbing the water with blotting paper applied to the dish adjacent to the mercury, but not in contact with the mercury.

The mercury was then transferred to a porcelain evaporating dish, about 2 or 2½ in. in diameter. The dish was placed in the center of a hot plate about 10 in. in diameter. The plate was heated by an alcohol lamp (with small flame) placed exactly below the center. A glass funnel about 7 in. in diameter was inverted over the evaporating dish. As the lower edge of the funnel, being in contact with the hot plate, was relatively hot and the upper part of the funnel relatively cool, the mercury vapor condensed mainly in the upper part of the funnel. Whenever the coating of mercury became thick enough to form globules, the funnel was removed, and the condensed mercury wiped off. About four hours were required to volatilize the 4 oz. of mercury. It was stated that more rapid distilling of the mercury would invariably result in a loss of all, or nearly all of the gold.

After the volatilization was complete, there remained in the evaporating dish a cake of finely divided gold, gold powder, practically impalpable, sufficiently coherent to permit of its transfer, unbroken, to a small bone-ash cupel, upon which it was reduced to a bead by fusing with a blow pipe. The bead showed, when weighed, a value of about \$8 to \$10 per ton. All this work was performed in my presence. No attempt was made at secrecy, and I was offered any quantity of the same sand (taken from a sack containing about 80 or 100 lb. of sand) to test by this or any other method; the statement being made that if I would faithfully use the same process I would assuredly get similar results. I was shown scores of beads, which I was told were obtained in this way. These represented the sand as worth from \$5 to \$30 per ton.

I accordingly took about 6 or 8 lb. of the sand to my own laboratory, where I carefully treated 1-pound samples in exactly the way described, but with absolutely negative results, although I made three trials of the process. I then made a cyanide test of the sand and extracted a very small quantity of gold. I do not recall the exact amount, but it was about 10c. per ton. I also made two or more fire assays, and obtained mere traces of gold. As I did not consider an examination of the deposit was justified, the investigation was then dropped.

GOLD IN COMMERCIAL MERCURY

About one or two years after this, I had a rather similar experience. The scene was in Nevada, where I was stopping for a few days. There had drifted

into this settlement, an old prospector, a Californian, a man of large experience in prospecting, and a really fine old fellow. Day after day he rode out in the morning, returning at night loaded with samples, which he carefully panned. A few days after I made his acquaintance, he told me of a discovery which he described as "mineralized porphyry, exactly like Goldfield ore, but it won't pan." He had been trying amalgamation, and said he judged he was getting \$20 to \$30 results. He needed help to stake the claims necessary to cover the ground, and asked me to join him.

We went to his tent, and he showed me the beads he had obtained by amalgamation. He had a small blowpipe outfit, with which he could fuse the beads. I repeated his tests on 4 or 5 samples, which he said were taken from outcroppings several hundred feet apart, and in every case obtained a bead similar to those he showed me. I then proposed to him to "try a blank," but he did not understand what I meant, and I explained to him I meant to test his mercury. He agreed at once, but said it was bought as "chemically pure" from (naming a prominent Pacific Coast house), and that it must be all right, because he had never used it before. I accordingly placed a bead about the size of a pea on a bone-ash (blowpipe) cupel, and upon volatilizing the mercury, obtained a gold bead of about the same size we had obtained from all of the tests.

Mercury loaded with extremely fine gold is doubtless responsible for many similar errors. If the gold be very fine, ordinary distillation apparently does not purify the mercury, as considerable quantities of gold are mechanically carried over with the vapor.

H. M. CHANCE.

Philadelphia, Penn., March 23, 1910.

Automatic Zinc Dust Feeder

I read with interest an article in the JOURNAL of Feb. 26, 1910, by James S. Colbath on an "Automatic Zinc Dust Feeder." He states that he is unable to give credit to the inventor. I am not sure whether I am right as to the originator, but during 1905, when I was chief assayer at the Tyee smelter, Ladysmith, B. C., William Kiddie, who had charge of the sampling mill at that time, worked out a sampler of this kind. In addition he had a horizontal arm with a sliding weight that enabled him to vary the size of the sample taken.

This made an efficient sampler as no matter how fast or unevenly the ore was fed, the percentage taken out for a sample was exact. At that time it was used only on material passing, say, a ten-mesh sieve.

CHARLES S. HURTER.

Hancock, Mich., March 18, 1910.

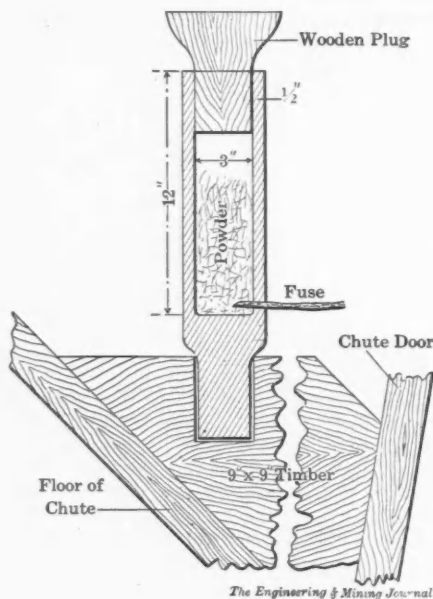
DETAILS of PRACTICAL MINING

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

Device for Clearing a Hung-up Chute

BY J. BOWIE WILSON*

All underground managers have at some time been worried by ore chutes choking and hanging up out of reach of the trammer's bar. When the material consists of fine clayey stuff the only remedy is practically to dig it out. If the material consists of rock, even if it contains a proportion of clay, and the block is due to the large pieces keying



CANNON FOR OPENING CHUTES

together and arching over in the chute, the following method of clearing the chute will be found better and certainly safer than attempting to shoot down the pass by tying pieces of dynamite to a tamping stick.

This scheme is used at the Mount Morgan mine in Queensland, and consists in firing a wooden plug from a small cannon placed in the bottom of the chute. The cannon is made from a length of steel shafting, the center being bored out in a lathe and a touch-hole drilled large enough to take the ordinary fuse in use at the mine. The end of the shafting is turned down to fit into a hole in the top of a short length of 9x9-in. hardwood timber of such shape that when the device is laid on the floor of the chute

*Consulting mining engineer, Sydney, N. S. W.

and resting against the chute door, the cannon will point up the center of the raise. The cannon is charged with ordinary black blasting powder and a plug of hardwood timber is tapped home in its mouth. A fuse is then inserted into the touch-hole to explode the powder.

In action the cannon is a big popgun, and on the powder exploding the wooden plug hits the keyed material with a good, sudden blow. If the shot is successful the material falls upon the gun and its carriage, but these, being of a simple design, are in no way hurt and can be recovered. A knock against the side of the truck suffices to clear the cannon of any material and it is thrown down in the tunnel beside the chute until required again. If the chute is not freed by the first shot it will generally be found to open after several. A great advantage of this method is that the men are in no danger when using it.

Making Bricks from Slag at the Great Fitzroy Mine

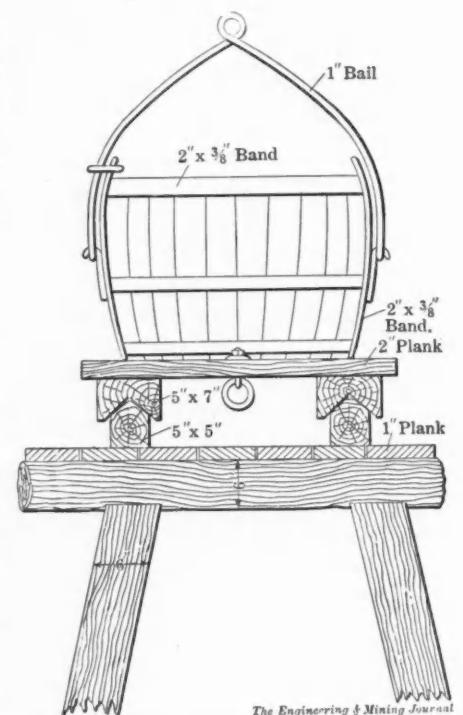
A prominent feature in connection with the extensive building operations now in progress at the Great Fitzroy copper mines, Mount Chalmers, Queensland, is the utilization of slag bricks for various constructions. The bricks have been used in the erection of offices and in the construction of water tanks, retaining walls, piers for ore bins, and bases for chimney stacks.

The mold used consists of two L-shaped cast-iron plates, and mention may be made of the following features, which have proved important: (1) The thickness of the metal, sufficient to chill the slag without becoming overheated. (2) The reëmbossing of the angles to minimize warping. (3) The adaptation of these reëmbossments to form distance pieces, by which means channels for air circulation are maintained between adjoining molds. These molds set upon edge and arranged to form rows of 20 molds are banked with about 1½ in. of dry sand or ashes. The slag is poured into the mold from the ordinary slag pots. As soon as the bricks have solidified, the molds may be removed and set up elsewhere. After 10 to 14 hours, the bricks are cool enough for handling. Their average weight is 80 lb. and they have withstood a crushing stress of 13 tons per square foot without showing any sign of failure.

Tram Car for the Prospector

BY GUY C. STOLTZ*

In the new Gowganda district, Ontario, Canada, where a real tram car is a luxury to the prospector, he has evolved the substitute shown in an accompanying sketch. The half barrel, strengthened by iron strips, is bailed and used as a bucket. It is hoisted by windlass from the prospect shaft, and at the surface it



BUCKET AND TRAM PLATFORM

is swung out on a movable platform and detached from the winding rope.

The platform, 3 ft. square, is made of 2-in. plank, fitted with notched runners, and rests on the inverted V guide rails, which are spiked to a floor, covering the trestle bents. The windlass men draw the bucket of waste rock to the dump at end of trestle by a rope attached to ring shown on platform. In summer axle grease is applied to the runners and guide rails, and in a freezing temperature water is applied.

A 10-unit vacuum plant, furnished by the Ore Concentration Company, Ltd., of London, has been contracted for by the Broken Hill Proprietary Company.

*Mining engineer, Mineville, N. Y.

Some Useful Knots for Engineers

BY A. LIVINGSTONE OKE*

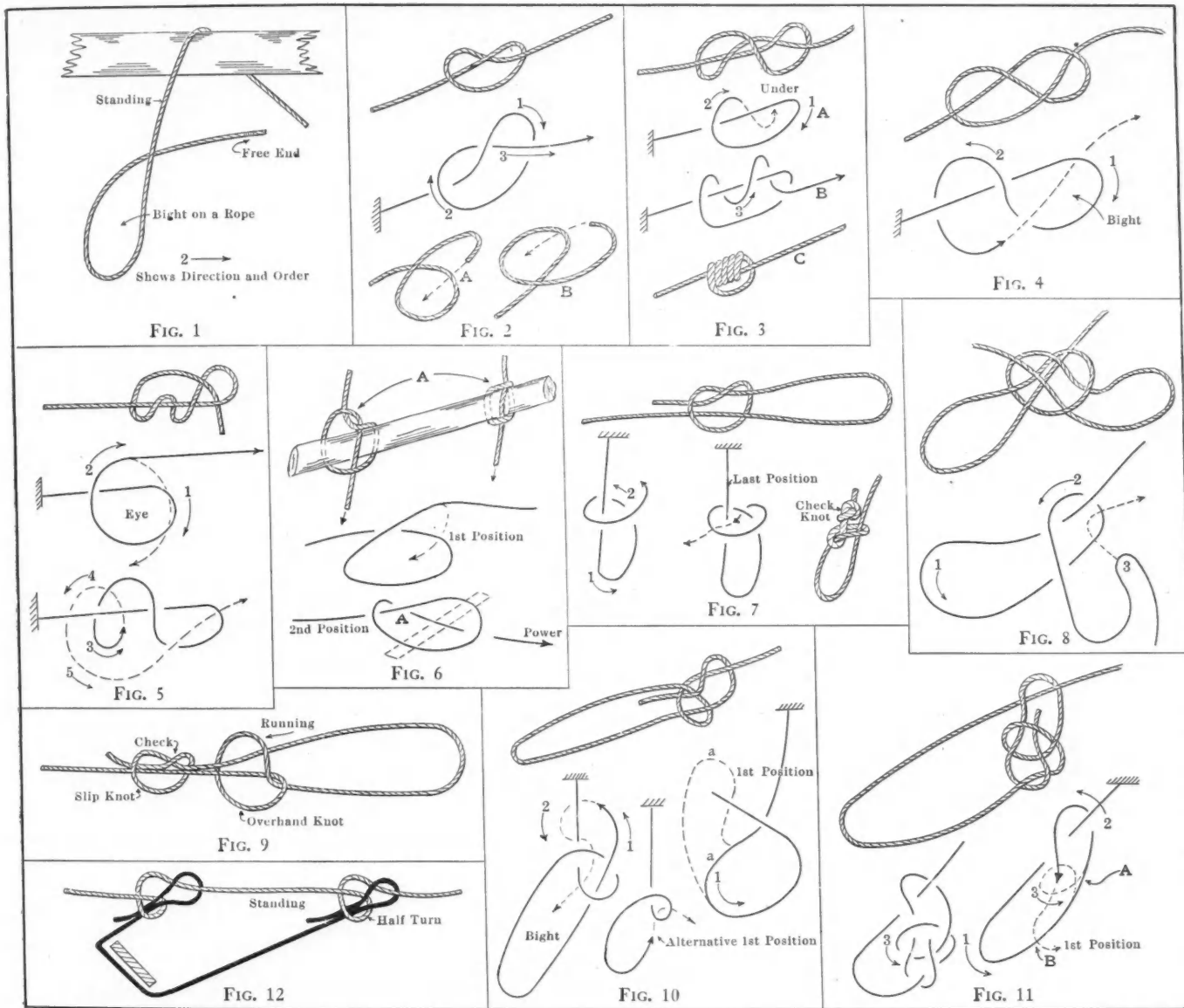
The knots described in this series of articles have been useful to me in my work in out-of-the-way places. Fig. 1 indicates the meaning of the terms employed.

made with any number of turns: A in the illustration shows the first position; B, the knot finished with two turns; and C, one with four full turns of rope.

Fig. 4, Figure-8 Knot (Flemish)—This knot may be employed as a stop on a rope; is less injurious to the fiber of the rope, and more easily undone than either the single or double overhand knot. If

point marked A must always be at the back of the spike or rung of the ladder, away from the direction of the weight or pull.

Fig. 7, Slip Knot (Simple Running Knot)—The simplest kind of slip knot. It may be used similarly to the packer's knot (which will be described in the next series) but is not so good, as it is liable



SIMPLE, STOP AND SLIP KNOTS, LADDER HITCH AND BOWLINES

The Engineering & Mining Journal

Fig. 2, Simple or Overhand Knot—This is the simplest of all knots to tie, and may be used as a stop on a rope. A free end is necessary to make it. If strained, it injures the fiber of the rope more than a figure-8 knot, and it is difficult to unmake and liable to jam.

Fig. 3, Double Overhand Knot—This knot is used for the end of a rope when it is required to prevent its going through an eye, as in a pulley block, or for the end of a halter rope. It is also useful for shortening a rope. It may be

made with the rope doubled and the bight left long, it becomes a figure-8 hoop knot.

Fig. 5, Stevedore Knot—The end of the rope is wrapped twice around the standing and then passed through the eye. It is useful as a stop on a rope to prevent the end going through an eye, as in a pulley block (see double overhand knot). It is also employed instead of sewing the rope end with twine.

Fig. 6, Boat Knot (Marline-spike Hitch)—Suitable for quickly making a rope ladder, or getting a temporary pull on a rope with a marline-spike. No free ends are required to form this knot. The

to pull through and does not bind on the rope.

Fig. 8, Tomfool Knot (Double Running Knot)—When the loops are drawn taut and the ends tied, this makes a pair of handcuffs which it is almost impossible for the person so secured to undo. It may be used as a barrel sling, half-hitches being put on the ends, and the hook put under the knot itself. The bight marked 3 is passed through the overhand loop as shown by the dotted line.

Fig. 9, Flemish Loop—This knot makes a simple loop for light work and may be used in the same way as a bowline, but is not so quickly made; neither is it so

*Mining engineer, Argentine and General Exploration Company, Ltd., Rodeo, San Juan, Argentina.

secure nor so easily undone. The security depends almost entirely upon the check knot.

Fig. 10, *Bowline*—A generally useful knot when a loop of any sort that will not slip is required, as in a sling for lowering a man, or fastening a bucket to a rope.

Fig. 11, *Running Bowline*—As shown in the first position a half turn is made at A (shown dotted) and the end passed through and to the back of the part marked B. This is a good slip knot and does not tighten on the standing, always remaining open.

Fig. 12, *Bowline II*—A method of attaching the end of one rope to the standing of another. A half turn is put in

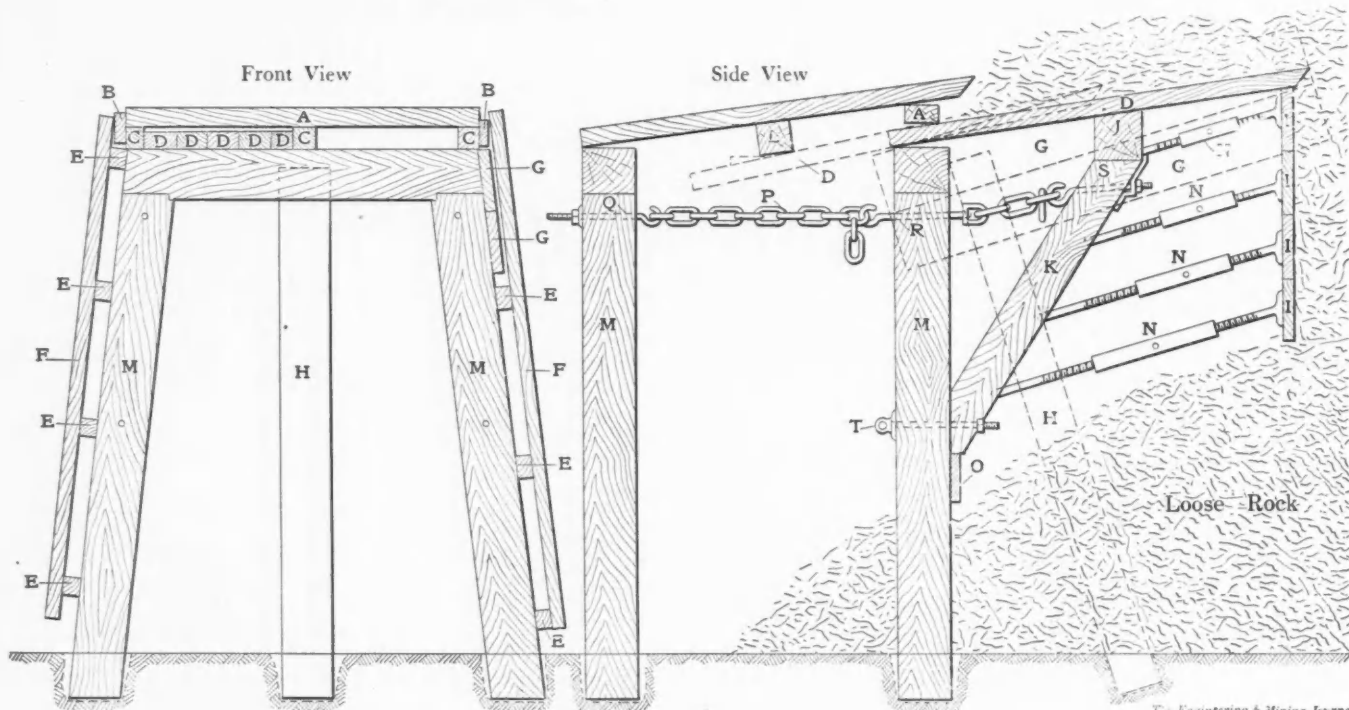
False Set for Spiling Ground

BY JAMES HUMES*

The tunnel being driven by the Austin-Manhattan Consolidated Mining Company, at Austin, Nev., is 7 ft. wide at the bottom, 6 ft. at the top and 8 ft. in height. The timber used is mostly 10x10-in. Oregon pine. The posts are cut 8 ft. long and placed in hitches. The caps are 4½ ft. in the clear.

When the writer assumed charge of the underground operations of this company the old style of false setting for spiling ground, which was sure though

This excessive cost set us thinking, and the result was the production of a false set that increased the footage driven in the worst ground about 10 ft. per week over our previous work. When we are sure we have reached ground that is to be spiled we stand the last set loosely, holding the posts in an upright position by spiking a 2x6-in. plank from the last set of timbers in place to each of the posts of the set about to be erected (M in the accompanying drawing). These pieces, and a temporary block placed on the center of the cap and against the ground, hold the timbers in position until the side bridging F is put in place and blocked.



A FALSE SET FOR DRIVING THROUGH LOOSE AND HEAVY GROUND

the standing and the end of the other rope taken through as in tying an ordinary bowline. This knot is practically a sheet bend.

(To be continued.)

Pipe Lines as a Factor in Rescue Work

The introduction of compressed-air pipe lines into all the workings of a mine might be utilized to provide fresh air and even food to men imprisoned after explosions or through falls. This does not involve much expense, as mines are usually equipped with compressed-air apparatus, and the piping leading into the mine is of such a nature as to withstand considerable damage from the exterior. Telephone wires inserted within the air pipe might also serve a useful purpose in saving life.

slow, was in use. This method was to stand the false set 2½ or 3 ft. ahead of the last main set and in order to do this it was sometimes necessary to blast out the bottom for the hitches, a dangerous practice at times on account of the position of the braces that held the breast boards in place. It required breast boarding for every 2½ ft. of lineal advance and was, in consequence, slow work.

The cost was high on account of the large amount of timber consumed (which costs here \$40 per M.), for the same braces that would answer for one set of breast boarding would not do for the next and the tunnel was always littered with discarded breast-board braces. It was only rarely that we could get in one set of timbers in 24 hours, and as all costs were charged up against this work of retimbering they amounted to more than \$40 per ft. for the spiling ground.

*Superintendent, Austin-Manhattan Consolidated Mining Company, Austin, Nev.

We are now ready to place the top bridging A, which consists of a 3x6-in. piece supported on 4x4x6-in. blocks C, one on each end and one in the center of the cap. These blocks are generally removed as the spiling is placed in position. After the spiling is driven home the space between the bridging and the spiling is filled with wedges which are taken out when the further end of the spiling is let down on the bridging of the next set.

While driving the spiling ahead, a 6x6-in. tailing block L is used. This tailing block should be sufficiently long to engage at least half of the spiling; oftener it should be long enough to reach across all of them and should be moved up as the spiling is advanced. When driving the back spiling there should also be at least two side spiling advancing on each side; these should be kept as far up as the back spiling. While driving the back and side spiling, one

man uses a light, sharp-pointed bar with which he removes the rock from before the spiling while his partner is forcing them up with a 12-lb. hammer.

When the spiling has reached a distance of 3 or 3½ ft. ahead of the last main set, the loose rock is pulled down to make room for the swing posts *K*, but none of it is shoveled out of the way into the cars until the swing set is pulled up tight against the spiling. Leaving this loose rock as shown in the drawing helps to sustain the mass hanging overhead. When the false cap is placed on the swing posts, the posts and cap are drawn up tight against the spiling by screwing up on bolt *Q*, the foot of the posts in the meantime being held in position by the bolt *T* and also supported by the block *O*. The fact that this set can be pulled up tight in this way is one of its advantages, for it obviates the necessity of driving wedges over the cap and against the spiling, the jarring of which sometimes results disastrously.

Everything is now ready to force the spiling in to its full length, and when this is done we are ready to go on with the breast boarding. The bonds are held in place by the iron braces *N* which have right and left screws or threads. The center pieces or nuts are made of 2-in. pipes plugged at the ends and tapped for the extension pieces, and have holes drilled in them to admit a small bar.

The end or foot piece of the brace next to the breast board is just a part of the rod bent at the angle shown. Each end of this foot piece is turned over into a slight point so that when it is backed up tight it presses into the plank and prevents slipping. The other end of the brace is rounded and fits into a hole about an inch deep bored in the swing posts.

These braces have not failed in a single instance, neither has any part of this swing set. It has often happened, in the old method of timbering, that downward pressure on the breast boards would push the braces below a horizontal position, and then, of course, they would fall out and leave the breast boards unsupported; but these iron braces can be placed at such an angle above the horizontal that the downward pressure on the breast boards cannot drive them out of place.

If the ground should project inwardly on either side, the swing posts can be swung to the opposite side; or if the ground projects on both sides, as sometimes happens, both posts can be swung toward the center of the tunnel and a shorter cap used.

The leaning post *H* shown in the center of the tunnel is used for bracing the center of the breast boards when the extension braces are taken out to admit of the main posts being placed in position.

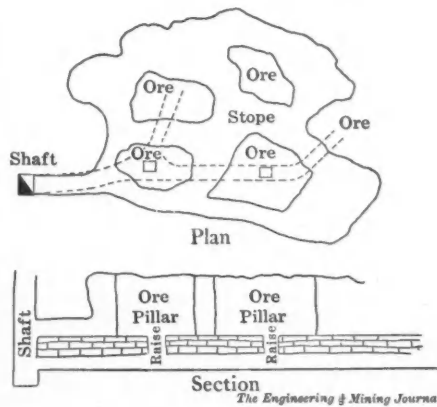
It is also customary to place a plank upright against the breast boards and overlapping all of them, and it is against this plank that the braces are placed. The hole in the swing posts for the eyebolt *T* is made large enough to admit of the above adjustment. When everything is in proper position and the chains are pulled up tight, this eyebolt is also tightened.

The miners like this method, for when they reach a point where there is a cave of considerable height, they can put this swing set in position under the protection of the last main set. They can then place plank or heavier material from the last set over the false set and thus protect their heads until they have the next main set in position.

The side spiling is worked forward as fast as the breast boards are put in place and overlapping them; this and the support the side spiling receives from the swing posts is sufficient to keep them in place until the main set is put up. There are only two side spiling shown in place in the drawing, but it is frequently necessary to spile the sides to the bottom of the tunnel.

Recovering Ore from Pillars

The accompanying sketch illustrates in plan and section a method of robbing pillars at a mine in the Joplin district. The ore occurred in a pocket, where the roof was heavy and a large amount of timber had to be used to enable even

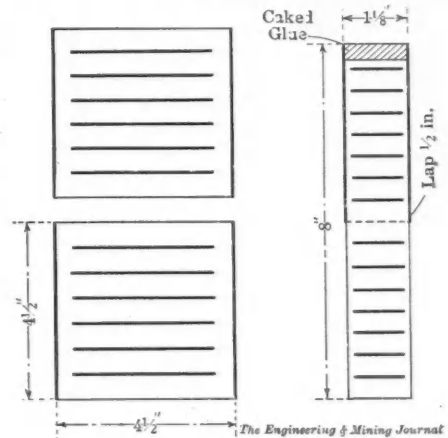


ROBBING ORE PILLARS

half the ore to be extracted. The pillars themselves contained a high percentage of ore. Beneath the body was a solid, compact limestone stratum. The shaft was sunk a few feet into this, and a sub-drift extended beneath the ore pillars with a 7- or 8-ft. roof. A raise was put up in the center of each pillar and the ore shot down into the drift below, and trammed to the shaft. This method gave a safe place in which to work and at the same time allowed nearly all the ore to be recovered.

Economic Tampers

"Economic Tampers" are being placed on the Joplin market for the use of mine operators by the Economic Explosive Company, Webb City, Mo. They have been experimented with for more than a year, and a number of companies are now using them in all their work. The tamper consists of a cardboard tube covered with paper and then filled with sand. It is the size of an ordinary 1½-in. stick of dynamite. The tube is made of two pieces of



ECONOMIC TAMPER SHOWING ARRANGEMENT OF SLOTS

cardboard, each 4½ in. square. Each piece of cardboard is slotted, and when bent to form a tube the slots extend entirely around the tube. Two pieces of cardboard are used in order to make a weak place in the center of the stick, so that when pressure of the tamping rod is applied the cartridge will bulge and fill the hole. The two pieces of cardboard are held in place by a piece of wrapping paper, the edges of which are glued together. The paper is crimped over the end of the tube to keep the sand in place.

The sand used is the fine material from the tailings mills, and is screened with a 10-mesh screen to take out any large pieces of rock and gravel. After the dry sand is put in and thoroughly packed, the top is covered with thin glue, which makes a hard cake ¼ to ½ in. thick. The tamper is placed in the hole so that the tamping bar strikes the caked top. This cake prevents the bar from breaking the paper and entering the sand, which in the case of an up hole would allow the tamping to run out.

The advantages claimed for this device are: a saving in the amount of powder used; more efficient use of the powder; safety in tamping as the sand does not come in direct contact with the fuse; and it is as easy to tamp uppers as down holes. The American Zinc, Lead and Smelting Mining Company, Cartersville, Mo., has been using this patent apparatus for 12 months with excellent results. The Little Princess mine has used it 10 months.

Granby Consolidated

Following the primary break on March 23, Granby stock continued to slump and on March 28, sold at \$37. The executive committee met on March 28, and after a long session issued the following statement:

"The tonnage reported by Dr. Sussman indicates that Granby has ore in sight which will require four to five years to mine and smelt at the highest rate of consumption in the past and this is independent of any custom ores.

"The report is highly favorable in all respects except for his opinion as to the probable results of further exploration of the company's properties. Upon this point, of course, opinions may differ.

"Exploration will continue as usual, and in the meantime the directors are not selling their stock. A further expert examination may be ordered by the board."

The directors of the company who are in New York, have declared that they have not disposed of their holdings in the company and have pointed out that during the recent examination of the property there were practically no sales of the stock. It has been reiterated that the developments following President Langeloth's visit to the mine came without warning, the inspection being purely incidental to the resignation of Mr. Hodges, the superintendent. Mr. Hodges, who has been in New York preparing to sail for Cerro de Pasco, has refused to explain publicly the discrepancy between his own and Dr. Sussman's statements about the mine, saying that as an engineer and former employee of the company he has no right to discuss its affairs. Mr. Hodges was present at the meeting of the executive committee on March 28. Among stockholders of the company, outside of the board of directors, there is great indignation and talk of calling the directors to account.

STATEMENT TO STOCK EXCHANGE

The essential part of the statement recently filed by the company with the New York Stock Exchange is as follows:

"The board of directors, Jan. 4, 1910, authorized the issuance and sale of 13,500 shares of the unissued capital stock of the company, and resolved that the stockholders should be entitled to subscribe therefor at the rate of \$85 per share to the extent of 10 per cent. of their respective holdings, as shown upon the books of the company on Jan. 20, 1910. Stock not subscribed for by the stockholders will be taken by the underwriters of the issue at the same rate, i. e., \$85 per share.

"The purposes for which the proceeds of the sale of this stock are to be used are not limited by the terms of issue except to corporate purposes. It is proposed, however, to use such proceeds

principally to meet outstanding obligations of the company, including a balance of \$875,000 still unpaid upon obligations in excess of \$3,625,000 incurred during the last 5 years for acquisition of mining properties, new plant and an interest in the Crow's Nest Pass Coal Company, and for other items properly chargeable to capital account. So much of the proceeds as are not used for these purposes will be reserved for working capital.

GRANBY INCOME ACCOUNT, SIX MONTHS ENDED DEC. 31, 1909

Produced:	
11,167,644 lb. copper.....	\$1,467,309
172,054 oz. silver.....	88,315
24,997 oz. gold.....	499,940
Total realized.....	\$2,055,564
Costs:	
Working expenses.....	\$1,669,512
Foreign ores purchased.....	81,406
Total costs.....	\$1,750,918
Net profit for six months.....	304,646
Surplus from June 30, 1909.....	2,698,687
Gross surplus.....	\$3,003,333
Less dividends.....	\$270,000
Less interest paid.....	17,365
Net surplus Dec. 31, 1909.....	\$2,715,968

GRANBY BALANCE SHEET, DEC. 31, 1909.

<i>Assets.</i>	
Mineral lands of consolidated companies.....	\$12,740,423
Mineral lands purchased.....	532,955
Plant and equipment.....	2,105,673
Lands, real estate and dwellings.....	126,366
Stocks and bonds:	
Crow's Nest Pass Coal Co. shares at first cost.....	\$858,814
Giant-California Mining Co. shares 50% of cost.....	45,000
B. C. Copper Co. shares.....	9,395
Shares with transfer agents, at cost.....	936
Kettle Falls Power, at cost.....	80,677
Total stocks and bonds.....	\$994,822
Supply department.....	\$257,553
Cash and copper:	
Foreign ore on hand, at cost.....	\$29,005
Granby ore on hand, at cost.....	17,375
Furnace bottoms and flue dust.....	50,000
Copper sold awaiting due dates.....	71,223
1,845 tons blister unsold at 13½c.....	609,729
New York office fund.....	1,909
Cash in bank.....	22,043
Total cash and copper.....	\$801,284
Total.....	\$17,559,076
<i>Liabilities.</i>	
Capital issued.....	\$13,500,000
Expenses accrued.....	\$27,542
Dec., 1909, wages.....	91,985
Dividends held for liquidator.....	1,429
Cash loan.....	875,000
Current accounts payable.....	97,152
Advances on copper in transit.....	250,000
Surplus Dec. 31, 1909.....	2,715,968
Total.....	\$17,559,076

"Approximately 8 to 10 million tons of ore are now developed ready for extraction in the company's territory."

During the six months ended Dec. 31, 1909, mine development amounted to 6874 ft., and diamond drilling, 3496 ft. The smeltery treated 572,371 tons of Granby ore and 9368 tons of custom ore. The total cost per ton of ore was \$2,868, and the cost per pound of copper was 10.1c., after deducting the value of the gold and silver.

Anaconda's Capital Increased

At a special meeting of the stockholders of the Anaconda Copper Mining Company held at Anaconda, March 23, it was decided to increase the capitalization of the company from its authorized issue of 1,200,000 shares, having a par value of \$25 each, to 6,000,000 shares of the same par value, also to extend the business of the corporation so as to permit the company to acquire, own and possess stock and securities of other corporations.

APPORTIONMENT OF NEW ANACONDA STOCK.

Name of Corporation.	Number of Anaconda shares.
Boston & Montana.....	1,200,000
Red Metal (Butte Coalition).....	500,000
Washoe.....	380,000
Butte & Boston.....	300,000
Big Blackfoot (Lumber).....	300,000
Trenton.....	120,000
Diamond Coal.....	100,000
Parrot.....	90,000
Alice Gold and Silver.....	30,000
Already outstanding.....	3,020,000
Total.....	4,220,000

The stockholders authorized the directors to offer stock as shown in the accompanying table in exchange for the entire assets and properties owned by the companies specified.

Alexander Agassiz

Alexander Agassiz died, March 28, on the steamship "Adriatic," while on his way home from Europe, his death being reported by wireless telegraph. He was 75 years old, and was a son of Professor Agassiz, the famous naturalist. He was born in Switzerland and came to this country when 15 years old. He graduated from Harvard and the Lawrence Scientific School; in 1859 he went to California as assistant on the Coast Survey. After leaving the Coast Survey he went to the Lake Superior country in 1866, at first as treasurer and a little later as superintendent of the Calumet & Hecla mines. About 1870 he was made president of the company, and had ever since been the chief executive of the company, directing its management and policy. Besides this work, he devoted much time to his researches in natural history.

We hope to publish an extended obituary on our next issue.

Edward N. Van Cortlandt

Edward N. Van Cortlandt died at the Engineers' Club, New York, March 29, aged 46 years. He was born in New York, and graduated from the Columbia School of Mines. For 20 years past he had practised actively as a mining engineer, dividing his time between New York and Denver, and was well known in both cities.

Statement of Utah Copper Company

In connection with its application for the listing of 1,198,889 additional shares on the New York Stock Exchange, the Utah Copper Company submitted the following data regarding some of its subsidiary companies. These shares make a total of 1,933,639 shares to be listed on the exchange.

The mining properties of the Boston Consolidated Mining Company, recently absorbed, consist of 380 acres adjacent to the mining ground of the Utah Copper Company in Bingham cañon, Utah. There have been already developed in the territory of the Boston Consolidated approximately 40,000,000 tons of ore yielding an average of 1.5 per cent. copper, which the company claims can be worked at a total cost of approximately 8½c. per lb. of copper produced. The Boston Consolidated concentrating mill has a daily capacity of approximately 3000 tons of ore, and the company is producing copper at the rate of about 25,000,000 lb. per year.

NEVADA CONSOLIDATED

The Nevada Consolidated Copper company is a corporation of Maine, with an authorized capital stock of \$10,000,000, divided into 2,000,000 shares of the par value of \$5 each, of which there are issued and outstanding 1,982,908 shares. Of the unissued shares, 4100 are held for the conversion of \$41,000, par value, first-mortgage convertible bonds still outstanding, out of a total issue of \$3,000,000, and 12,992 shares are held for the purpose of exchanging the same for the stock of the Cumberland Ely Copper Company under the terms of an offer to the stockholders of the latter company, dated Nov. 3, 1909, whereby the Nevada company agrees to exchange one share of its stock for each three and one-quarter shares of the stock of the Cumberland Ely company.

Under the terms of this offer, the Nevada company has acquired 1,257,776 shares of the stock of the Cumberland Ely Copper Company, being all the issued share capital of that company excepting 42,224 shares.

The Nevada company owns in fee 63 lode mining claims in the Robinson mining district, White Pine county, Nevada, aggregating approximately 850 acres. Two mines have been developed, one by a shaft of about 450 ft., where ore has been developed to the extent of at least 8,000,000 tons of an average copper content of about 2.4 per cent. The mine is fully equipped and ready for operation.

The company also has developed an immense body of ore lying near the surface on what is called the "Copper Flat" mine, with an average copper content of 1.84

per cent. Mining is here conducted entirely by steam shovels, and there are already developed in this orebody at least 29,000,000 tons. The company is producing copper at the rate of approximately 70,000,000 lb. per annum.

The Nevada company, together with the Cumberland Ely company, owns the en-

BOSTON CONSOLIDATED BALANCE SHEET, DEC. 31, 1909.

<i>Assets.</i>	
Investment:	
Acquisition of properties	\$1,000,000
Purchasing claims, development, equipment, etc., to Oct. 1, 1909	3,522,028
Bingham equipment, etc. (purchases this year)	1,120
Garfield equipment	6,288
Pelican Point millsite	159
Office furniture and fixtures	1,078
Total	\$4,530,673
Current:	
Cash on hand, New York and Boston	\$8,285
Accounts receivable, New York	5,427
Accounts receivable, Salt Lake	16,046
Total	29,758
Inventory:	
Warehouse at Bingham	\$52,052
Warehouse at Garfield	47,189
Porphyry ore at mill	13,055
Concentrates at mill	15,041
Concentrates at smeltery, not settled	64,997
Concentrates at smeltery, settled	309,905
Sulphide ore at smeltery, not settled	11,693
Sulphide ore at smeltery, settled	42,586
Copper metal	238,207
Auxiliary operations, work in process, Bingham	1,101
Auxiliary operations, work in process, Garfield	3,347
Taxes at Salt Lake	10,554
Total	809,727
Suspense:	
Bingham development in ore	\$207,243
Bingham prepaid ore cost	6,840
Garfield suspense	13,669
Salt Lake miscellaneous	1,949
Total	\$229,701
Grand total	\$5,599,859
<i>Liabilities.</i>	
Capital stock and surplus:	
Capital stock—authorized and issued	\$1,000,000
Surplus as at Oct. 1, 1909	373,216
Add profit for three months to Dec. 31, 1909	34,340
Total	\$1,407,556
Current:	
Cash—overdraft at Salt Lake	\$46,873
Accounts payable—sundry creditors	2,334
Accounts payable—A. S. and R. Co. United Metals Selling Company	561,561
Notes payable	107,000
*Boston Consolidated Copper and Gold Mining Company, Ltd.	3,346,907
Accounts payable—Salt Lake payroll	3,641
Accounts payable—Salt Lake miscellaneous	118,139
Total	\$4,186,455
Deferred:	
Accrued interest	734
Reserves:	
Freight at Salt Lake	\$1,678
Unclaimed checks and time checks	1,952
Miscellaneous	1,484
Total	\$5,114
Grand total	\$5,599,859

*The item "liabilities to the Boston Consolidated Copper and Gold Mining Company, Limited," amounting to \$3,346,907, will be extinguished by the delivery of 40,000 shares of Utah Copper Company stock.

tire capital stock of the Steptoe Valley Smelting and Mining Company, of the Nevada Northern Railway Company, and the entire first-mortgage bond issue of the railway company.

CUMBERLAND-ELY

The Cumberland-Ely Copper Company is a corporation of Maine, with an authorized share capital of \$6,500,000, divided into 1,300,000 shares of the par value of \$5 each, all of which has been issued.

The company owns 48 mining claims, aggregating 523 acres, in White Pine county, Nevada, lying near and adjoining the properties of the Nevada Consolidated. This mine is developed by a shaft fully equipped to produce 1500 tons of ore per day, the average copper content of which is about 3.4 per cent.

The Nevada Northern Railway Com-

UTAH COPPER COMPANY.

INCOME ACCOUNT, DEC. 31, 1909.

51,749,233 net lb. copper, at 12.96c.	\$6,706,752
Debit difference in copper settlements for period 0.045c.	23,431
Total	6,683,321
Net price applying for the year's sales, at 12.915c.	\$417,247
20,862,345 oz. gold, at \$20	417,247
198,943.15 oz. silver, at 51.528c.	102,511
Shipments of ore other than concentrating	4,311
Rents received	13,050
Interest, freight refunds, etc.	6,604
Total	543,723
Operation	\$7,227,044
Mine development	\$2,274,356
Prepaid expense—ore stripping	113,128
Freight on ore	133,714
Treatment and refining	762,081
State of New Jersey, annual license tax	1,779,866
	4,113
Total	5,067,258
Net profits for period	\$2,159,786
Interest on bonds	\$5,348
Dividends paid	1,464,387
Total	1,469,735
Net surplus for 12 months ended Dec. 31, 1909	\$690,051

pany is a corporation of Maine, with an authorized and outstanding capital stock of \$2,000,000 divided into 20,000 shares of the par value of \$100 each, and also has an outstanding mortgage indebtedness of \$1,000,000. Its property consists of about 165 miles of single-track railroad, running from the connection of the Southern Pacific at Cobre, Nevada, to Ely, Nevada, and to the mines of the Nevada Consolidated and Cumberland-Ely companies, and connecting with the concentrator and smeltery of the Steptoe Valley company. The railway is fully equipped and in profitable operation.

The Steptoe Valley Smelting and Mining Company is a corporation of Maine, with an authorized capital stock of \$10,000,000, divided into 100,000 shares of

the par value of \$100 each. There have been issued and outstanding 74,000 shares, of which 42,000 shares are owned by the Nevada Consolidated Copper Company and 32,000 shares by the Cumberland-Ely Copper Company.

The property is situated at McGill, White Pine county, Nevada, about 25

miles from the mines of the Nevada Consolidated and Cumberland-Ely, and consists of a concentrator, smelting and converting plant, and the necessary buildings and equipment connected therewith, having a capacity of upward of 6000 tons of ore per day, with provision for further enlargement when necessary.

The Utah Copper Company has continued the development and operation of its properties largely by steam-shovel mining and, as reported in the annual and quarterly reports issued by the company, is producing copper at the rate of approximately 60,000,000 lb. per annum at a cost of about 8½c. per pound.

The Alaska Coal Land Inquiry

Representatives of the Morgan-Guggenheim syndicate appeared before the Ballinger-Pinchot investigating committee in Washington on March 25 and 26 for the purpose of testifying with reference to the interests of that syndicate in Alaska, its relation to the Cunningham coal-land claims under consideration before the committee, and various related subjects. The representatives who spoke before the committee were Messrs. Birch and Steele, most of the testimony, however, being given by Mr. Birch who stated that he was the managing director of the Morgan-Guggenheim syndicate in Alaska and was permanently stationed at Kennicott, Alaska. Some of the testimony offered by Mr. Birch had been developed at a former hearing before the Senate Committee on Territories but very much more was brought out by the questions of the counsel and by members of the investigating committee itself.

MORGAN-GUGGENHEIM OPERATIONS

Mr. Birch said that the Morgan-Guggenheim syndicate consisted of J. P. Morgan & Co., and some of the members of M. Guggenheim Sons. The syndicate was usually known as the Alaska syndicate and it was interested in the Northwestern Commercial Company as well as in other concerns—the Northwest Fisheries Company, the Alaska Steamship Company, the Kennicott Mine Company, the Copper River & Northwestern Railway Company and the Katalla Company. Some of these were controlled by the syndicate and the stock of some was held in the treasury of the Northwestern Commercial Company, of which latter the syndicate owned 46.2 per cent. Mr. Birch described the operations of the various concerns and their relation to the railroads and mining operations of the territory. He further reviewed the status of the Cunningham claims and the relation between the Cunningham claimants and the Morgan-Guggenheim syndicate but without bringing out anything of special novelty in this latter connection.

Of more interest was his discussion of the value of the coal underlying the Cunningham claims. On this point he developed a number of details that had not been considered before the Senate Committee on the Territories. When con-

fronted with a statement made before the Committee on Territories concerning the value of the coal he said that the statements then made were accurate, "assuming that the coal could be mined for \$1.75 and sold for \$2.25" and that there were 500,000,000 tons of coal there. Mr. Birch further said that his testimony before the Committee on Territories was not under oath, whereas his testimony before the Ballinger-Pinchot committee was under oath. Moreover, when speaking on the former occasion (he added), "had I realized at the time that I was talking to a press gallery I might have been a little more careful in what I said."

INVESTMENT IN ALASKA

When Mr. Birch was asked how much the Alaska syndicate had invested in Alaska he said he thought about \$15,000,000, including the railroad it owns, \$10,000,000 of that amount being represented by the railroad itself while the syndicate is under contract to spend about \$5,000,000 more or \$20,000,000 in all. Questioned by members of the committee, he conceded that the Alaska syndicate was engaged in practically all industries and businesses in Alaska, but that the getting of returns from the investment in copper mines and the other investments depends in large measure upon the opening up of the coalfield of which the Cunningham claims form a part. As to the possibility of using the coal the following colloquy between Mr. Birch and Mr. Vertrees, attorney for Secretary Ballinger, occurred.

MR. VERTREES. Where do the Pacific Coast people get their coal?

MR. BIRCH. They get their coal from the local coal mines, from British Columbia, and from Australia, and even from Japan. The vessels come over from Australia empty to take back wheat and bring over the coal as ballast, and bring it in very cheaply.

MR. VERTREES. So, in the matter of establishing the market of which you speak, even if the coalfields and areas of Alaska were developed, they would have to compete with the coal from these foreign countries you have mentioned, much of it coming in as ballast, as I understand you.

MR. BIRCH. Yes, sir; and the coal that we are now using in the construction of

our railroad, we import from British Columbia, because of its superior quality.

MR. VERTREES. Do you know anything of the cost of mining coal in the United States?

MR. BIRCH. Yes; I have some memorandums.

MR. VERTREES. I wish you would state to the committee what may be considered as the range of prices of the cost of mining coal in the States; that is, in the coal areas of the States, that we may get some approximate idea or data to figure upon.

MR. BIRCH (after referring to paper). The cost of coal mining, as reported by the Philadelphia & Reading Coal and Iron people, in their annual report of 1902, was \$2.25; in the State of Washington it runs from \$1.60 to \$2.40; the cost of mining at Vancouver island averages about \$1.75, and the cost of mining coal in British Columbia, because of the cheap Asiatic labor, is about \$1.40 per ton.

MR. VERTREES. Do you know what is considered as the return realized per ton upon coal mined in the States—I mean bituminous coal and also anthracite coal—what experience has shown is the net return?

MR. BIRCH. I know of one instance, of the New River Collieries Company, where the profit was only about 0.4c. per ton.

MR. VERTREES. What is considered the average return, do you know, in the United States—I speak now of bituminous coal?

MR. BIRCH. Well, it runs from 1c. or from a fraction of a cent up as high as 15c. per ton.

MR. VERTREES. What about anthracite coal—can you give an estimate as to that?

MR. BIRCH. I can only give you the report, which shows in the neighborhood of 20c. a ton.

MR. VERTREES. Stated in other terms, that means, then, that is about the value of coal in the ground, is it, per ton?

MR. BIRCH. No, sir; that is after it is mined there is that profit.

MR. VERTREES. That profit?

MR. BIRCH. Now, the value of coal in the ground itself is very much under that. There are coal lands in Virginia and Kentucky that do not earn more than a cent and even under a cent a ton in the ground.

The Cobalt District in 1909

BY REGINALD E. HORE *

The silver production of the Cobalt district for the years 1904-1909 was about 62,415,395 oz. valued at \$33,000,000. The cost of production was about \$16,000,000 including about \$4,000,000 for smeltery charges and freight deductions. The net profit to shareholders was therefore about \$17,000,000. There was no large original investment of capital. The plants grew with the progress of mining, and were built by the profits on sales, and are charged to cost of production.

In 1909 the production was about 25,000,000 oz. valued at \$12,500,000. The

of 1909. It is also likely that thorough prospecting will result in the discovery of many more veins. As in all bonanza camps, however, there is a delightful uncertainty concerning the future, though it appears that Cobalt will be a large producer for five years at least. The finding of new veins is the mine manager's most serious problem, in comparison with which he finds the extraction of the ore an easy one.

POWER PLANTS

An important advance during 1909

The mine operators are, however, paying high prices for fuel, due to the long haul by rail, and they are pleased to see rival companies racing to supply them with power from the rivers.

THE RAGGED CHUTE PLANT

The Cobalt Hydraulic Power Company is installing, at Ragged chute, a 5500 h.p. air-compressing plant which is the largest in the district. The air is compressed by the Taylor hydraulic system and collected over water in a rock chamber under a pressure of 125 lb. The



PANORAMIC VIEW AT SOUTH END OF COBALT LAKE; NIPISSING PROPERTY AT LEFT; MCKINLEY-DARRAGH AT RIGHT



BUFFALO MINE AND MILL



LA ROSE MINE, COBALT

year's profit was about \$6,500,000. As in previous years some rich veins were worked out and others proved disappointingly low grade at depth. On the other hand, rich shoots were found in other veins, and several more rich veins discovered. The net result is that there is to-day more ore in sight than at any previous time, though the amount is still small in comparison with the market value of shares.

There is good reason to believe that the production for 1910 will exceed that

*Houghton, Mich.

was the progress made in the construction of plants on the Montreal and Matabitchouan rivers, which will supply the camp with cheap power. For mining purposes Cobalt has many natural advantages: A good class of miners who can work to best advantage in the splendid though rigorous climate; convenient supplies of timber and water for mining purposes; splendid facilities for shipping by rail; hard compact country rock which requires but little timbering; only a few feet of glacial debris covering the ore-bearing rocks, and the ore concentrated by nature to an unusually high degree.

air is conducted to Cobalt, about eight miles, through a 20-in. steel pipe and will be distributed to the mines by loop lines of 12-in. pipe. The same company is already supplying electric power to the mines.

MINES POWER, LIMITED

The Mines Power, Limited, is putting in a plant on the Matabitchouan river, 25 miles from Cobalt, to develop electric power. The water will drive four turbines, direct connected with generators. The power will be transmitted by aluminum wire to three substations at Cobalt,

Kerr Lake and South Lorrain. At the first two stations there will be electrically driven compressor plants, and air will be delivered by pipe lines to the surrounding mines.

Beach Brothers have installed a plant at Hound chute. The head is 35 ft. and the power available is utilized to drive four water wheels connected with as many generators. Power is transmitted by copper wire to Cobalt from which the plant is six miles distant.

MILLS AND CYANIDE PLANTS

In 1909 concentration became for the first time an important factor in the district. Early in 1908 there were three

Iron Ore Mining in Eastern United States

The conditions of the iron trade in 1909 worked to the advantage of mining interests in the eastern district and 1909 witnessed record operations by many established producers, while a number of important deposits were opened up.

LAKE CHAMPLAIN DISTRICT

In the Port Henry district, shipments during November were the largest in its long history and contracts closed for 1910 delivery indicate an output of fully 1,000,000 tons. An additional concen-

1909 included the beginning of shipments from the Herkimer district, where the Salisbury Steel and Iron Company has expended a large amount in developing mines and installing a concentrating plant, though as yet the movement of ore has been rather light. In Dutchess county two recently organized companies are preparing to resume the development of the Kelly and Dover Furnace deposits of brown hematite, one of them guaranteeing minimum shipments of 100,000 tons per year. At Benson Mines a nodulizing plant was recently placed in operation; shipments of crude ore and concentrates were begun several months ago, going as far west as Ohio and south to central



FOSTER AND UNIVERSITY MINES. GIROUX LAKE AT RIGHT



CROWN RESERVE MINE, COBALT



PETERSON LAKE, NOVA SCOTIA MINE IN DISTANCE



RIGHT OF WAY MINE IN CENTER; LA ROSE AT RIGHT

mills in successful operation and at the beginning of 1909 three others had begun to treat ore. During the summer two more were added and others are now nearly completed. In the three plants, first in operation, treatment was uniform in reducing with crushers and rolls and sizing in tromeels. In the later plants stamps are used with more satisfactory results. In treating the pulp from the stamps, Wilfley and James tables and Callow tanks are used.

During the year two plants were installed to treat slimes by the cyanide process without amalgamation, and are said to be working satisfactorily. The two mines, Buffalo and O'Brien, recently made shipments of bullion representing the results of this treatment.

trating mill is under construction by Witherbee, Sherman & Co., Inc., at Mineville, and the Port Henry Iron Ore Company has made large expenditures on its property during the year.

Late in the year, the Bethlehem Steel Corporation acquired the Presbrey interests, slightly over 50 per cent., in the historic Cheever mine, north of Port Henry, and its output will be increased materially. There is also increased interest in the large deposits of titaniferous ores in the Lake Sanford district, situated in the Adirondacks some 40 miles west of Port Henry, and a connecting railroad line is projected.

Other New York State developments of

NOTE—Abstract of article in the *Cleveland Iron Trade Review*, Jan. 27, 1910.

Pennsylvania. The Forest of Dean mine, in the Hudson River district, now well along in its second century of operation, is producing at an increased rate.

OTHER EASTERN WORKINGS

New Jersey mines yielded large tonnages during 1909, though the loss of the Hibernia mine, through a remarkable earth movement peculiar to that district, was serious. The same condition resulted in a serious accident at the Oxford mine during the autumn. The Richards mine continued to produce heavily and still shows a large tonnage available. The output of the Cornwall district in Pennsylvania was also large. Interesting improvements were made by the Cornwall Ore Banks Company during the year.

Extraction Percentages in Metallurgical Plants

BY H. A. MEGRAW *

At first glance it might seem that the calculation of the per cent. of metal recovered in a metallurgical plant is a matter of simple arithmetic, about which there could be no two opinions. In some cases this is true, but in others there is wide latitude for argument. Some of the systems used at different plants are truly wonderful and the number of methods or systems seems to be limited only by the number of plants in operation.

Where the process of extraction is in one operation, as for example in concentrating plants, the comparison of the content of the ore delivered to the mill, with that of the produced concentrate, shows at once the proportion saved. In plants, however, where the treatment requires considerable length of time, or where two or more processes are used in connection, the problem is not so simple. Of course it goes without saying that any report of per cent. extracted should have for its basic figures the actual content of the ore delivered to the plant and the actual content of the bullion, concentrate or finished product.

In estimating the content of ore delivered, consideration must be given to the methods of weighing and also to the proper deductions which have to be made for losses which may occur between the point of weighing and the point where extraction begins. These losses include tare, moisture, etc. Few mills have accurate methods of weighing the ore delivered, and this is a point which in some cases may explain abnormal extraction results which seem difficult to account for. Tare is another item to which attention should be given. The weight of a car or other means of conveying ore will change and for accurate results the weight should be checked from time to time in order to be sure that the proper figure is being used. A small error in the weight of a car may amount to enough to vitiate results, due to constant repetition and therefore accumulation of the error.

Moisture samples should be carefully and frequently taken in order to approximate as closely as possible the actual conditions. The average percentage of moisture in the ore sent to a large mill is not by any means a simple matter to determine, and it seems that great frequency is about the only way of getting a fair average. In wet ore the greatest care should be taken, having in view the fact that a difference of 1 per cent. in

the weight of the gross amount of ore delivered may make a serious difference with the metallurgical end of the business.

To use a concrete case as a basis for calculation, take for instance a plant where concentration is followed by cyanide treatment. When the milled ore is classified and each grade concentrated separately, it would be a good plan to ascertain just what proportion of the whole constitutes each class. The efficiency of the process for each class may then be derived. The total value of the tailings can be found by combination of the tailings for each class in the proportion which constitutes it. The figures showing the content of the concentrate will show the actual extraction when compared with the total content of the ore. Extractions by assay should check closely with the actual production, but in any case the actual production must be taken for accurate reports of extraction. The closeness of the results derived in the two ways show the efficiency and care with which the work has been done.

CYANIDE PLANT METHODS

After concentration there are two general methods which are followed in cyaniding: (1) The separation of the product into two classes, sand and slime, and treating them separately; (2) the treatment of the whole product as slime, and regrinding the necessary portion. In the first case it is important to know just what proportions are treated in either class, and their respective values. The quantity of material in each tank or charge should be carefully computed, and its content in metal, together with an assay of the heads and tailings, recorded. It is well to observe that the usual methods of assaying tailings from cyanide treatment are more or less faulty. The general error is in taking too small a quantity of pulp for assay and not having sufficient checks. It would be a good idea for one considering this matter to figure out what would be the actual weight of a gold or silver button resulting from the amount of pulp used for the tailings assay. In a good many cases it will be found that it would be too small to be weighed on any balance, and that tailings assays are largely a matter of guess work. I have seen assays made on 50 c.c. of cyanide solutions. Of course accurate results are impossible in such a way.

Tonnage calculations of sand and slime charges should be carefully made,

using as a basis data secured from repeated and careful calculation. This is simple enough on sand and slime charges where the specific gravity of the dry pulp has been ascertained, and means provided for determining that of each charge treated. In this way percentage extractions from each charge handled should be determined and recorded. Assay results and bullion production really should agree within certain limits, depending upon the condition of the plant and the kind of work done. If the figures do not check, steps ought to be taken to find out the reason, which will usually be found as due to inaccurate work in some part of the plant. Sometimes leaks in the plant itself or other mechanical faults may be found accountable, but these cases are in the minority, and faulty data or calculations will be found to be the reason.

In those rare and fortunate cases where the ore delivered to the mill is practically constant as to value and character, it may be sufficient to calculate the monthly production against the content of ore delivered to the mill during that month and call it per cent. extracted. In cases where the ore varies in character or amount milled, it is quite a different matter.

DIFFICULTY OF MONTHLY CUTOFF

It is evident that the concentrate produced in any given month should be considered as derived from the ore milled during that same month. It is also evident that the bullion produced during any given month does not correspond to the ore milled during the same time. The cyanide treatment occupies a length of time depending on the class of ore and the method of treatment: Sands from 6 to 20 days, and slimes from 2 to 8 days. Ore upon which treatment is started at any given time will begin to give up its values a few hours later and continue to do so during the entire time of treatment, and the rate of extraction will vary largely at different times. It is quite evident that it is not an easy matter to cut off treatment at the end of any given period and say what production belongs to the previous and what should be attributed to the future time. Of course, if the ore is always of the same grade and the same amount is milled each month, it is sufficient to assume that the overlap from a previous month will about balance the amount carried forward. Where the ore varies no such assumption can be made.

As a matter of fact the only really accurate method would be to carry the

*San Luis de la Paz, Guanajuato, Mexico.

treatment for a long period, say six months at least, and include in the calculations for production the amount in solution in the mill and the amount in combination with the zinc in the precipitation boxes. The amount present in solution or in process of treatment can be approximated closely enough to serve as a fairly accurate basis but the amount in combination with zinc is a point upon which there are very few data to guide, and which would be too expensive to ascertain. It is, in all probability, less than general opinion assigns it. I had an opportunity to gage this amount in cleaning up a plant which had been in long operation. The metal in combination with the zinc proved to be about 10 per cent. of the average monthly production of the plant. This was in a plant treating low grade silver-gold ore. This one instance, however, cannot be safely taken as a basis for calculation. It is possible that a higher-grade ore may leave a greater proportion of its values in the zinc. This, it seems, is quite likely to be the case with gold ores.

The first month or two of operation of a plant of this kind will not give results up to the general standard for the reasons previously mentioned and also on

account of mechanical imperfections which have to be discovered and remedied. After that time results should be nearly standard, unless there is some special reason for other deductions. The amount of metals in solution or in suspension in a mill, contrary to some opinions, does not increase except with the grade of the ore, and then only proportionally. With the same ore and the same process, the amount in a mill at the end of 10 years' work should be the same as at the end of the first year.

MONTHLY EXTRACTION STATEMENTS

Although it is impossible to show in a monthly report the real percentage of extraction secured during that time, it is advisable for purposes of monthly reports that some system should be followed for approximating it, and some plan of calculation could be devised and systematically followed, which will give a fair idea of the work being done. The following may be considered a suggestion along these lines:

Take the actual content of the ore delivered to the mill as 100 per cent. The concentrate produced will show a certain per cent. of this total. Say, for example, the content of the concentrate

shows 20 per cent. of the total. This leaves 80 per cent. of the total to be treated in the cyanide plant. Then calculate the total head content of all the tanks discharged during that month. Use this as 100 per cent. in the cyanide plant and against that calculate the bullion product for that month. Presuming that the cyanide extraction is 80 per cent., then the percentage of the total ore milled, represented by the bullion product, would be 80 per cent. of the 80 per cent. which the cyanide plant has to treat, or 64 per cent. of the total ore treated. Adding to this the percentage derived from concentration we have, $64 + 20 = 84$ per cent., representing the total month's work.

This may not be the only solution of the problem, and other methods may be as good or better, but it is reasonable and does not depend altogether on either ore milled or bullion produced during any stated time, and it will afford a good idea of what is being done at the plant. By following this system for a term of months it would show a final accuracy and a greater evenness than if gross production were charged every month against the gross value or content of ore milled.

Lake Superior Iron Ore Shipments

The completed statement of iron-ore shipments from the Lake Superior district in 1909 shows a total of 42,586,869 tons, of which 41,683,599 tons were forwarded by Lake and 903,270 tons by rail. The total compares with 26,014,987 tons in 1908, and 42,266,668 in 1907. The records of the district have been carefully kept from the beginning, and are compiled and published yearly by the *Cleveland Iron Trade Review*, so that statistics of the past production of each mine can be ascertained.

The following table shows the production of each range in 1909, the total production from the first shipments to the end of 1909, and the date of the first shipments from each range; the figures being in long tons:

Range.	Year 1909.	Total to End of 1909.	Year Opened.
Marquette.....	4,256,172	91,903,991	1854
Menominee.....	4,875,385	71,313,115	1877
Gogebic.....	4,088,057	60,820,503	1884
Vermillion.....	1,108,215	29,125,385	1884
Mesabi.....	28,176,281	195,703,424	1892
Total.....	42,504,110	448,866,418	....
Baraboo.....	82,759	880,627	1893
Total.....	42,586,869	449,747,045	....

The Baraboo range in Wisconsin is included, although it is outside of the immediate Lake Superior district. Some geologists, however, hold that it is really an extension of the Gogebic range. The

Helen mine on the Michipicoten range in Canada, which is not included above, shipped 170,065 tons in 1909, all to the furnaces at Sault Ste. Marie.

The Vermillion range showed the smallest gain in 1909, not because the mines are exhausted, but because the Steel Corporation found it more advantageous to push shipments from the Mesabi. All the Vermillion mines are Steel Corporation mines, except the old Section 30, which is still under development. For similar reasons no shipments were made from the Great Northern leases, on the northern side of the Mesabi. The Steel Corporation shipments from the whole district were 50.4 per cent. of the total, against 56 in the preceding year.

In 1908, only three mines shipped more than 1,000,000 tons, but in 1909, nine mines are found in this circle of big producers. They are the Adams, Burt, Fayal, Hull-Rust, Mahoning, Morris, Stevenson and the Virginia or Oliver group on the Mesabi, and the Newport on the Gogebic. Of these mines, the Hull-Rust is the leader, with 3,039,911 tons, being more than a million tons ahead of its closest rival, and eclipsing all previous records for any iron mine on the Lake Superior ranges, and doubtless for any mine in the world.

The Fayal mine took the leadership

of the Mesabi range in point of total shipments, having sent down at the end of the season a total of 18,132,550 tons, passing the record of the Mountain Iron mine, which was 17,198,871 tons. This change in the relative positions of the mines is made possible by the shut-down of the Mountain Iron, from which no shipments were made during 1909, and only a very small shipment in 1908. The Mountain Iron is by no means worked out, but active work there has been discontinued for business reasons.

NEW PROPERTIES

A number of new properties appear on the list this year. Among the new mines are the Syracuse, Pearson, Euclid, Perkins and Bray on the Mesabi range; McDonald on the Menominee, and the Stegmiller on the Marquette. This latter mine is a property of the Steel Corporation, which for some unaccountable reason, has been spoken of in recent publications as the Brotherton, but it has no connection with the well known Brotherton mine on the Gogebic range.

The largest shipper on the Marquette range in 1909, was the Cleveland-Cliffs with 877,433 tons; on the Menominee, the Chapin, with 587,647 tons; on the Vermillion, the Pioneer, with 477,226 tons.

Method of Square Set Stopping at Bisbee

Adapted to Mining Soft or Hard Ore. Reduces to Minimum the Amount of Waste Sent to Furnace. Details of Framing Timbers

BY MORRIS J. ELSING*

The square-set method of stoping is used almost exclusively in Bisbee, Ariz. A few orebodies have been worked by other methods but they are small in comparison. There is probably no other camp where square setting has been worked out with such accuracy and detail as here, especially in the Copper Queen mines.

OREBODIES

The orebodies vary from soft to hard irregular masses of high-grade ore in altered limestone and porphyry, often intimately mixed with bunches of low-grade ore and waste with usually no definite foot- or hanging-wall. The ore varies from soft aluminous and ferruginous clays to firm pyrite with 1/2 per cent. copper, to almost solid chalcocite containing 65 per cent. copper. The oxidized ores are represented by malachite, azurite and cuprite in altered limestone. A small amount of native copper and some of the less common oxides complete the list. Usually the ground is quite heavy and the ore can be removed in small sections only. For the conditions, square setting although expensive is by far the best method of mining.

RAISING

Preliminary to stoping, a two-compartment raise, consisting of a chute and manway, is run to the level above which is usually 100 ft. If the orebody extends only a short distance above the level, the raise is run only to the limit of the ore. Connection is made with the level above for three reasons, all of which contribute to cheaper mining:

- (1) A quick and economical system of getting waste filling.
- (2) A means of securing better ventilation.
- (3) An easier method of getting timbers into the stope as they may be lowered rather than hoisted.

The raise is usually placed at the corner of a section so that it may serve two or more sections.

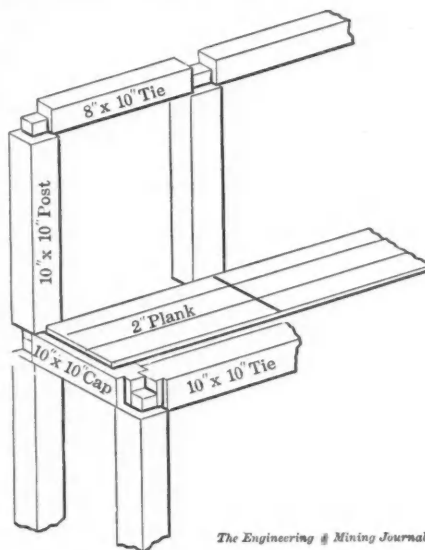
After the raise has been run, some idea of the weight of the ground can be formed, when the size of the section to be carried up and the timbers to be used are decided upon. The size of the section will vary from 3x5 sets, when two or three floors only are worked simultaneously, up to sections 5x7 sets in ground that is easily supported, when

*Mining engineer, P. O. Box 825, Bisbee, Ariz.

more than four floors are worked at one time. The size of timbers varies from 10x10, 10x12 to 12x12. Recently quite a number of round timbers have been used.

STOPPING

The actual method of breaking the ore varies with the formation. For example in a soft material, room for timbers can be made with a pick and shovel. The ground may be slightly harder when an auger is used and a stick of powder breaks and loosens the ground, making



SQUARE SET USED AT BISBEE, ARIZ.

it possible to use a pick to advantage. Again, where the ground is still harder drills of the Shaw type are used to put in a round of holes. It sometimes happens that a 2 1/4-in. column drill is used. In such a case considerable ore can be mined ahead of the timbers, while in the first case timbers are put in as soon as room is made for them. In stopes where the soft ground runs and is quite heavy a majority of the sets are top- and side-spiled and sometimes even breast boarding becomes necessary. In such cases a jack screw is used to put in the spiling in order to prevent any unnecessary jar from causing additional caving.

The timberman takes the order for the set and the order is immediately sent to the sawmill where the timbers are framed and delivered within two hours. In rush orders, timbers are sometimes delivered in 15 min. after the receipt of the order.

FRAMING

The framing is done by a Denver Engineering Works double-end timber framer, run by a 40-h.p. motor. The regular posts are framed both ends alike. The timber used in stopes ranges from 10x10 to 12x12 in. Posts are either 10x10, 10x12 or 12x12 in. The horn on a 10x10-in. post is 5x5x5 in. long and placed at the center of the post; that on a 10x12 is 5x5x6 in. long. The tenon on a 10x10 cap is 1 1/2 in. long, 5 in. wide, 10 in. high. On a 10x12 these dimensions are the same except that the tenon is 12 in. high. On a 12x12 cap the tenon is 2 in. long, 6 in. wide, 12 in. high.

Formerly a 10x10 tie was used with 10x10 timbers, but now an 8x10 tie is used. The tie is unframed and for all practical purposes the 8x10 tie has proved just as efficient as the 10x10. The reason for this is that a cap or tie rarely fails at any place other than the point where the cap or tie rests on the shoulder of the post. A cap or tie broken in the middle is a rare sight. Failure is due almost entirely to the crushing of the bearing surface against the post. The bearing surface of an 8x10 and a 10x10 are the same, consequently except where the lateral pressure is great, an 8x10 tie is used because of a saving of 7 1/2 bd.ft. in addition to the cost of framing. A 10x10 tie, when used, has a tenon 2 1/8 x 8 x 10 in. high.

SILL FLOOR SETS

The sill floor set depends upon the nature of the ground on which the floor is started. If the floor is waste, a flat-bottom post is used resting on a small block with 4x6-in. spreaders between the posts. If the ground is ore subsequently to be mined from below, either a cap sill and tie or a mud sill is used. A cap sill and tie, being the more substantial, is used around a raise which it is desired to keep open whether the ground be ore or waste. In the second set from the raise if the floor is waste, a flat-bottom post is used if the ground is sufficiently hard to support it; if the floor is ore a cap sill and tie or a mud sill is used. The object in using a cap sill and tie or a mud sill is to work up from the level below and mine out the ore under the first stope without causing the waste filling to cave into the stope below. In very soft ground even though the floor is waste, a cap sill and tie is used in order to give a good foundation for the sets above.

The cap sill and tie supporting a floor with waste filling can easily be caught up with stulls and posts. In general where the floor is on ore, if the ground is heavy, the cap sill and tie is preferred to the mud sill.

The sill set consists of posts 8 ft. 8 in. to 9 ft. to the shoulder, posts being placed 5 ft. center to center with caps and ties completing the set. The 10x10 caps and ties are 4 ft 7 in. long; the 12x12 caps 4 ft. 6 in. long. Roof planks rest on the caps. When 10x12 posts are used the 12-in. dimension is tie way.

The floors above the sill are similar except in the length of posts. For a long time 6 ft. 2 in. posts with 10x10 timbers and 6-ft. posts with 12x12 timbers have been used. Recently 7-ft. posts have been used entirely, which not only reduces the cost of timbering by saving 11 bd.ft. per set, but still further reduces the cost of mining.

VERTICAL PRESSURE

The object of framing posts so that the horns abut is to obtain the maximum resistance to vertical pressure. The end-grain resistance of the timber is the greatest and, therefore, best adapted to withstand the vertical weight of the ground above.

A stope is worked out much upon the same principles upon which timbers are relieved, that is, when a floor begins to take weight it is time for the floor above to be started in order to relieve the one below. The ground is worked out about 8 in. above the set, thus giving some time before the actual weight of the ground comes down upon the timbers. If the floor has many broken caps and ties it is an indication that the stope has not been worked sufficiently fast.

By following this principle of stoping it is possible, in the same kind of ground, to mine the ore with smaller timbers and a less amount of reinforcing timber. In some ground that it has been almost impossible to mine because of the tremendous crushing weight, the size of the section has been reduced and smaller timbers used; by simply working the section fast enough the same ground has been mined with comparative ease.

GOBBING

Gobbing keeps pace with stoping. A monthly open-set report shows just how many sets remain ungobbed at the end of each month. The number of open sets in easily supported ground rarely exceeds 75 to 100, while in heavy ground this number is not over 30 to 40. The gob is usually obtained from the prospect drifts and raises on the level above. Often two sets on the side of a section next to ore are lagged and not gobbed, with the idea of using them as a raise when the next section alongside is mined.

FLIRTING, BEVELING AND CUT DOWN POSTS

When the roof pressure becomes great and the timbers are forced out of alignment, flirting is resorted to in order to square up the sets. Flirting is changing the position of the horn on the bottom of the post so as to bring the posts in alignment. For instance, if the posts on the floor have swung to the left then the post above is cut with its bottom horn on the left side of the post, thus throwing the post to the right. In this way the post is thrown in or out, right or left, from 2 to 3 in., keeping the stope square. With all the posts in line it makes it possible to resist the pressure of the ground much more effectively.

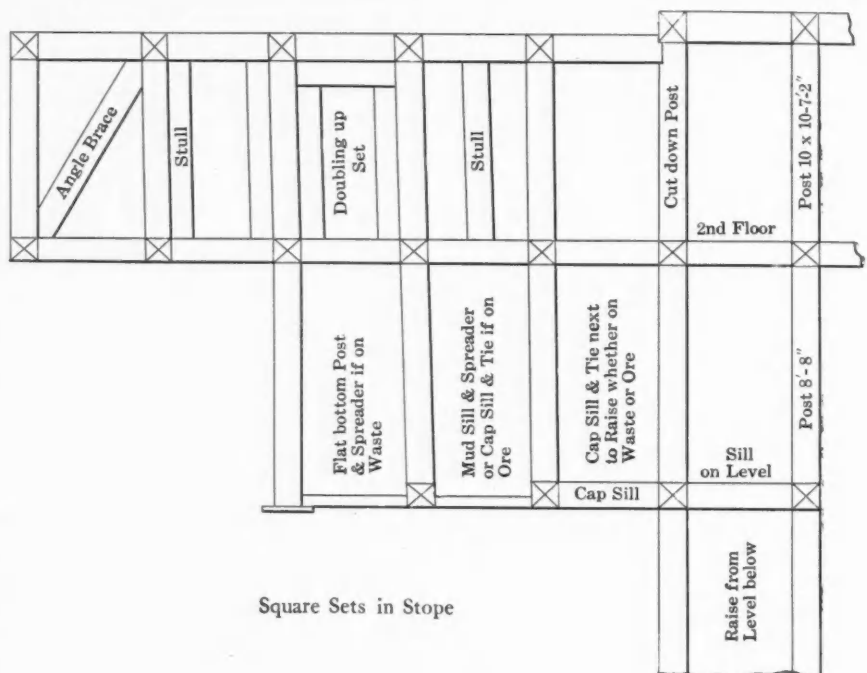
Where the sets in a stope have swung so far to one side that the maximum flirt

Order No. 1 is for a flirited post and is read as follows: One post 10x10, 7 ft. long, flirited 2½ in. capway and 2 in. tie-way, right. In writing the order for a flirited post the timberman always imagines himself standing under the cap and flirts the post toward himself and the tie either to the right or left as the case may be. The second order is for a beveled cap, one

ORDER.

- (1) P. 10x10 7 ft. F. 2½ C. 2 T. R.
- (2) C. 10x10 4 ft. 6 in. 1½ x1 B.
- (3) C. 10x10 4 ft. 6 in. 1½ x1 Rev. B.
- (4) C. 10x10 4 ft. 6 in. ½ B. 1 E.
- (5) C. 10x10 4 ft. 6 in. ½ D. B. 3 sides B.

end to have a bevel of 1½ in., the other end 1 in. The bevel in this case is known as a straight bevel, both bevels being in the same direction. The third order is for a cap with a reverse bevel, that is, the bevels are in the opposite direction. The fourth order is for a cap with one end



The Engineering & Mining Journal

DIFFERENT TIMBERS USED IN SQUARE-SET SYSTEM

will not line the post up with the rest of the posts a beveled cap and tie are used. The object in doing this is to make the cap or tie fit squarely against the horn of the post in order to make use of the total bearing surface on the shoulder and against the horn of the post.

In order to keep the caps and ties level when a stope has settled, the cut-down post is used. The shoulder is cut the required distance below the regular shoulder and flat with the horn.

In heavy ground where the lateral pressure is great, posts are battered out at the top against the ground so that by the time the stope begins to take weight it usually has gained an upright position. This batter often amounts to ½ in. per foot.

ORDERING TIMBERS

The accompanying order illustrates the method of ordering timber at these mines.

only beveled. The fifth order is for a cap with what is known as a drop bevel. The drop-bevel cap is used when connection is made with two posts of different elevation, especially in connecting with an old stope. These orders apply to ties as well as caps. The above orders are merely a few examples of the accuracy and detail with which square setting has been worked out at Bisbee, the object in view being to obtain the maximum strength with the minimum number of board feet.

It may be said that too much refinement and accuracy in measuring and cutting timber is not warranted. The latest practice has been to put in regular sets, allowing a stope to get considerably out of plumb and level before it is squared up. Perhaps every three or four floors a stope will be properly squared up by ordering, perhaps every set a special. Both time and money are saved by not at-

tempting to keep the stope in perfect alinement.

CONCLUSION

Thus far, although square setting is recognized as an expensive method of mining, no other has been found applicable. It readily adapts itself to the irregularities of those orebodies where on one floor the ore may widen out and on the next pinch, while on the third it may be high grade but include considerable waste. No caving or slicing method can fulfil these requirements because with their application there is bound to be considerable mixing of high-grade ore with waste. This loss in itself would more than make up for the increased cost of mining by the square-set system. Besides

- (3) The preservation of the surface.
- (4) The facility with which it lends itself to prospecting by intermediate drifts.
- (5) Its great value as a prospect agent at the same time the ore is being mined.

In conclusion it may be said that for the majority of the orebodies in Bisbee the square-set system is by all odds the best. If there is any improvement in the method of mining here it will probably be some modification of this system by which the cost of timbering and stoping will be reduced.

Montgomery Shoshone Consolidated

During the fiscal year ended Dec. 31, 1909, the Montgomery Shoshone Consolidated Mines Company, at Bull-

ore in sight on account of irregularity of the deposits. He estimates 9500 tons of \$6.50 ore broken and stored in the stopes. Development is being done at the lower, or 700-ft. level.

In the mill the average value of the concentrates treated during the year was \$357.20 per ton, with an average extraction of 97.76 per cent. A tube mill, five agitating tanks for concentrate treatment, one clarifying tank, one 6-ft. Chilean mill, a large agitating tank for slimes and a 40-leaf vacuum filter were added to the mill.

The Radium Business

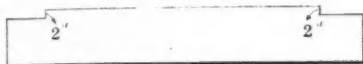
The sale of radium by the Austrian State department, which controls its production, has now been placed on a more or less permanent footing, says the London correspondent of the Sun. The chief difficulty encountered by the department has been to find a suitable way of packing the precious mineral, but the experts of the Vienna Physical Institute have at last devised a satisfactory way of handling it.

Pure radium, of course, cannot be obtained; but what is sold as radium is really a chemical compound known as radium-barium chloride. Of this there are three different grades in the market. The preparation is inclosed in a so-called radium cell, a round capsule 1 7/8 in. in diameter and 3/4 in. long. This capsule is inclosed in a screw tube made of nickelled brass, with a lead bottom in which there is a little sunken square which serves to hold the speck of radium.

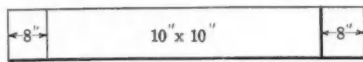
The cell or capsule itself is sealed by a mica plate, which obviates the necessity of opening it when in actual use. All tubes are carefully numbered and each bears an official stamp. Prospective buyers may note that it is not money alone that buys radium. It is only scientific institutes and savants of repute who are eligible as purchasers.

Postal-guide books are searched in vain for rules governing the despatch of radium. No postoffice has ever been called upon to handle a single milligram. In every case so far the sales have been made to buyers personally or their direct representatives sent expressly to Vienna for the purpose. It is not surprising that in the case of a product worth \$2,375,000 an ounce, the strict rule is "shipment at buyers' risk."

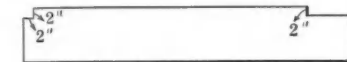
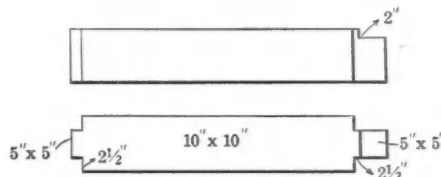
Selenium is a rare element having peculiar properties. In the dark it is a poor conductor of electricity but in the light it becomes a good conductor, and on account of this peculiarity it is used in a number of electrical devices. It has been used in telephoning along a ray of light and also in transmitting pictures by telegraph.



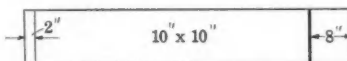
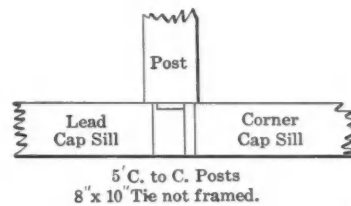
Lead Mud Sill.



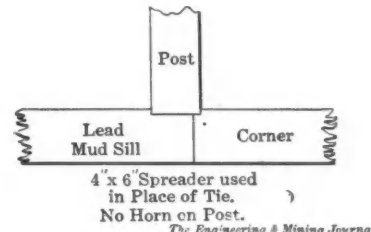
Corner Cap Sill.
5' C. to C. Posts



Corner Mud Sill.



Lead Cap Sill.



DETAILS OF FRAMING SQUARE-SET TIMBERS

it has other advantages of preserving the surface where it is valuable, and of permitting prospect work by means of intermediate drifts. One important feature of the square-set system which is often overlooked when considering its merits and demerits, is its adaptability to prospecting. If an irregular orebody or stringer of ore is encountered in prospecting soft ground it can be most easily and thoroughly prospected by actual stoping. The ore can be followed wherever it goes and at the same time it is being mined.

Therefore arrayed against the one disadvantage of higher cost there are the advantages as follows:

- (1) The adaptability to mining soft or hard irregular bodies in caving ground.
- (2) The reduction to a minimum of waste to be smelted with the ore.

frog, Nev., earned a net profit of \$86,703. There was treated at the mill of the Bullfrog Reduction and Water Company, a subsidiary concern, 68,632 tons of dry ore, the average value of which was \$7.51 per ton, or a total value of \$515,513. The total milling cost was \$156,049, equivalent to \$2.27 per ton. The average extraction for the year was 85.97 per cent.

Of the above tonnage, the Montgomery Shoshone Mines Company produced 65,106 tons and the Shoshone Polaris Mining Company 3526 tons. The total mining cost, including all development work done during the year, was \$140,756, equivalent to \$2.05 per ton. A total of 6982 ft. of development work was done.

John G. Kirchen, manager, states that it is impossible to estimate the probable

Mount Morgan Mine Records and Assay Plans

Rock Drill Cuttings Used as Samples. Recording Diamond Drill Holes.
Assay Plans Assist in Producing Ore of Uniform Grade for Mill or Smeltery

B. Y. J. BOWIE WILSON*

The advisability of every mine, whether developing a deposit or after it has reached the production stage, keeping a set of assay plans, on which are recorded the value of the ore exposed or mined, should be too well appreciated to require any championing. I think it will be admitted by all mining engineers, who have managed a mine of any size, that assay plans are an absolute necessity if it is desired that the ore sent to the works for treatment should keep at a fairly even grade, and not vary over wide limits from month to month. Without a complete set of assay plans of the mine, it is impossible for a manager to determine what grade of ore the mine is capable of supplying and, to so regulate the output of the various stopes that the month's output will fairly represent the mine's capacity as a producer. These remarks apply more to a developed and producing property. If assay plans are a necessity for a producing mine, they are no less to be desired in a mine that is being prospected and developed. If all the assays obtained during the prospecting stage of a mine's career are placed upon a plan, in their proper position, it is infinitely easier to understand their relation to each other and, by studying the assay plan carefully, to determine the possibilities of the property.

VALUE OF ASSAY PLANS

Assay plans of a mine that is being developed will also be found of great assistance when the property is offered for sale, or capital is required for its further equipment. However roughly these plans are kept, they will be of use to the engineer who will have to inspect and report upon the property. It gives him something tangible to start with and, if on checking some of the work he finds it reliable, will greatly reduce his labor.

No one method of keeping assay records and plans can be laid down as being the best, as each field and district has its own peculiarities and any system used must be adapted to the requirements of the deposit. As progress in all things is greatly assisted by the free exchange of ideas and criticisms thereon, the following account of the system introduced at Mount Morgan, Queensland, may be of interest and use.

The subject naturally divides itself into the main headings: (1) Sampling; (2) assay records, and (3) assay plans.

*Consulting mining engineer. Vickery's Chambers, Sydney, N. S. W.

SAMPLING

Three different methods of procuring samples were employed: (1) Sampling by hand in the open cut; (2) from the rock drills when mining underground; (3) by diamond drill cores. In sampling in the open cut, where the oxidized ore was quarried from the faces of benches or milled down chutes, two classes of samples were taken. One set was taken to act as a check upon the ore sent to the works, and was procured by the men working in each face throwing two handfuls of material from each truck into a heap from which, at the end of the day, a sample was taken. Samples were procured in the same way of any mullock (waste) trucked away from a face.

As much hand picking was done in the open cut a set of samples was taken each day, under the direct supervision of the overseer. These could not be taken as representing the value of any particular face in bulk but were used by the overseer in assisting him to decide what class of material in a face had to be discarded, as being below pay value. Neither of these sets of assays would stand the criticism of men accustomed to accurate and careful sampling but, when combined with frequent "dish samples" washed by the overseer, who had been in charge of the open cut at this mine for many years, they gave results quite accurate enough for the conditions.

SAMPLING BY BORINGS FROM ROCK DRILLS

All the underground mining is done by rock drills and all the samples from this class of work are procured by collecting some of the fine borings or dust from all the holes bored in a face. This method of obtaining samples entails no extra expense. All the shift boss has to do is to write an assay ticket for each face that will bore out on his shift, and either collect the sample himself, or send a drill boy to the miner in charge of the face with a ticket and a sample cloth to hold the sample. As the collecting of the sample entails no hand work there is no tendency to shirk it, which must often occur when chip sampling in hard rock is delegated to subordinates. This method of sampling by the borings of rock drills has often been checked at Mount Morgan and has always been found satisfactory.

Of course, it must be remembered that the ore is uniform in appearance and that the gold occurs in such a fine state that it is almost an unknown thing

for any gold to be visible in the stone, even when the rock carries several ounces to the ton, so that it is impossible for anyone to manipulate the samples by taking more from a hole that is known to be in good stone or *vice versa*. Miners who have worked in the mine for years are unable to give even a rough estimate of the value of the rock before it has been assayed. This method would be inaccurate in ore of varying degrees of hardness, where the men select the position of their holes largely by the hardness of the rock. Chip sampling has to be very conscientiously done under these circumstances to be more accurate, especially in the presence of coarse gold.

In prospecting with the diamond drill the whole of the core was taken as the sample, the procedure being as follows: Wooden boxes were made 4 ft. 6 in. long, with slots arranged in such a way that when the lid of the box was shut no core could possibly get out of its slot. As the core was withdrawn from the hole it was placed in one of these boxes in its proper sequence, and every morning the officer in charge of the sampling went round and inspected the cores in the boxes. After making any notes about the geological nature of the core, the occurrence of dikes, etc., he wrote out labels showing the depth represented by the core in each slot, and any remarks he wished entered in the assay book. The labels were placed in the boxes among the cores; the boxes were locked and sent to the assay office. Here the whole of the core in one slot, after any dike that was present had been discarded, was crushed and sampled in the usual way.

ASSAY RECORDS

Too much stress cannot be laid upon the necessity of keeping all assay books with sufficient clearness to leave no doubt about the exact locality from which each sample came. When entering the assay, it may appear a waste of time to put in much detail as, the work being fresh in mind, there is a tendency to think that you will always remember where the sample came from. The great necessity for clearness was forcibly impressed upon me when in 1901 I started to make assay plans of the Mount Morgan mine from the old assay records. The mine had been worked many years, but no assay plans had been kept. The hours spent in attempting to plot the assays in their correct position from the old assay books, assisted by the former mine manager's

monthly reports, left an impression that will not be easily obliterated.

Making clear assay records and plans is, of course, open to the objection that by placing all your information and knowledge of a deposit clearly on paper, it is easier for another man to reap the benefit of your labor and that your services are not so indispensable to your employers. A man who thinks that he can only hold his position by preventing other men from learning, and not by showing that he is the best man for the job, had better retire early as he is doomed to failure. A manager should always remember that all his knowledge about the mine is not really his property but that of his directors and, therefore, should have his work in such a condition that in the event of his leaving the mine, his successor will be able to carry on the work as well as possible.

To follow the Mount Morgan method, it must be remembered that all the gold ore is mined by the square-set system with sets 6x5 ft., and 7 ft. 9 in. in height. This divides the mine into a series of floors which are numbered from the top downward. If a new level is opened, it is easy to calculate how many floors there will be up to the next level and start it off with its proper number. The various stopes upon a floor or level, which are either by dikes or blocks of unpayable stone, are given names such as south, southeast, north, etc. The first set taken out upon a floor is numbered 1, and the rest in the sequence of their extraction.

THE STOPE BOOK

A stope book is kept in the mine office. This book is ruled in squares and each set is put in its position by marking around a square, and at the same time its proper number is written in the square. This gives a rough plan of each stope as the work progresses. At short intervals the stopes are checked by the mine surveyor, who, when making the mine-working plans, enters upon each set its proper number from the mine stope book. In sending samples from the stopes to the assay office they are labeled to show the floor, number of set and stope. In sending samples from drives, winzes, etc., their name or number and the distance from some marked plug or from some definite level is given so that from the assay book the exact position of the sample can be easily noted upon the plan.

ASSAY RECORD BOOK

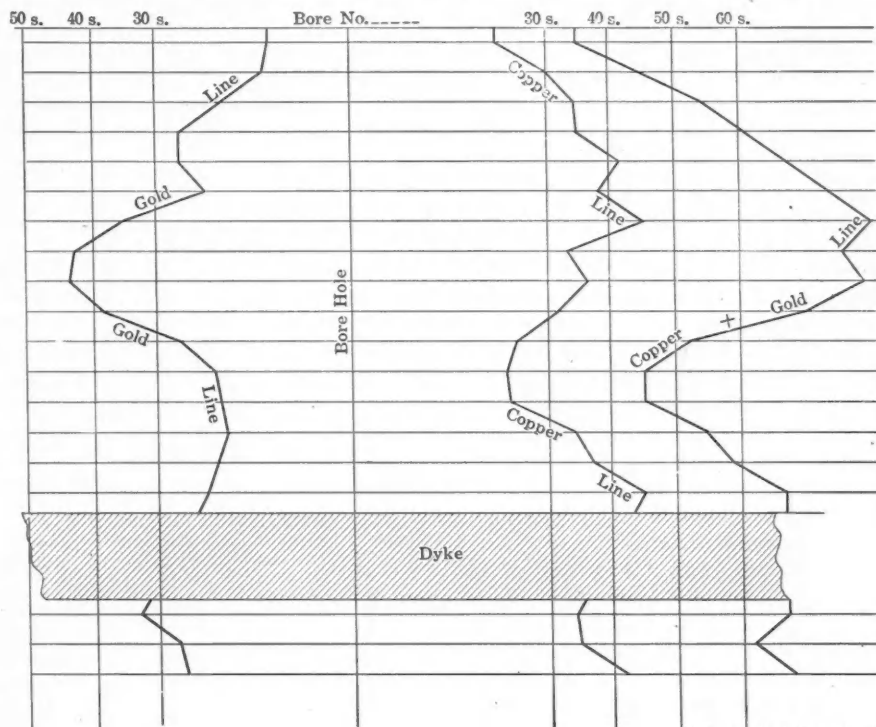
An assay book is kept in the mine office, in which the daily assays are entered from the assay-office slip. All the assays for a 4-week period are kept together, and the book, being ruled into columns, a separate column is kept for each stope or drive worked during the period. At the end of each 4-week period, the book is closed and a fresh set of pages started.

This method of opening up fresh headings each 4 weeks, although it may appear cumbersome, has the advantage that it keeps all assays of work done during one period together, and fits in with a 4-week statement drawn up to show the tonnage and value of all ore sent from each stope and floor to the works, the total of which should tally with the average of the daily samples taken on the works during the same period. It also shows approximately the date of the work as the only dates entered in the assay book are those to identify the periods. In this assay book are kept notes of any dikes encountered and also the disposal of the rock mined. For example, if a set is mined, that the assay shows is too low grade to be sent the works, its assay is entered with the rest, but an

sumed would represent its position on the plan. Periodically the survey party surveyed the stope, plotted the ground that was actually out, and then corrected the shift-bosses' plan. At first a fair amount of manipulation was required to make the two plans check, but after the chambers were properly started, little alteration had to be made on the shift-bosses' stope plans to make them agree with the ground actually mined. A separate plan was made for each cut or floor as the chambers were mined upward.

ASSAY PLANS

A complete set of working plans, consisting of a plan for each floor in the mine to a 20 scale, was kept in the survey office, and upon these every set that had been mined was shown, and num-



RECORD USED AT MOUNT MORGAN MINE FOR DIAMOND-DRILL HOLES

M is put against it to show that it has been mullocked.

When a start was made to mine the copper-gold orebody, which was found to the northwest of the old gold stopes, the square-set method of timbering was abandoned and a chamber and filling system introduced. This necessitated an alteration in the method of keeping the records of where the assay samples came from. As all the shift bosses were accustomed to the method just described, the following modification was adopted. The survey department supplied the mine with plans of the copper stopes ruled in 5-ft. squares, to a scale 20 ft. to one inch. Upon these plans were marked all fixed points such as winzes, chutes and known dikes, to help the shift bosses identify their position on the plan. When a machine was rigged up the shift boss wrote a number in the square, which he as-

bered. All the sets mined in the one-half year were colored with a distinctive tint. Of course only the plans of the main levels show any drives, but all plans showed the shafts and winzes. The assay plans were duplicates of these, but instead of the sets having numbers printed on them they contained the assay value of the ore mined, a sample being taken for each set. The gold contents are put in pennyweights and decimals of a pennyweight. On the main floors the contents were plotted along the drives, and where a horizontal diamond-drill hole existed they were surveyed and plotted and the assays for each 4 ft. 6 in. of length written on. Vertical bores could, of course, only be shown by circles. The position of all dikes and other geological features were shown. Of course in a body such as mined at Mount Morgan, where the pay ore occurs in masses which

merge into unpayable ore, it was necessary to enter up any widths. The work entailed in starting these assay plans in 1901, after the mine had been operated nearly 20 years, was naturally enormous, but their usefulness amply repaid the time thus spent and without them it would be almost impossible to now work the mine to a fairly even grade. When the plans are once uptodate, it requires comparatively little labor to keep them going, and I should strongly recommend a mine manager to keep his own assay plans personally, and not delegate this work to an assistant. In no other way can he keep in such an accurate and personal touch with the progress and contents of his stopes. The very action of writing on the assays impresses one much more than reading over a plan that someone else has made. Gold assays are put on in black ink, copper is red and the silica contents of the copper-gold ore in blue.

DIAMOND DRILL RECORDS

When the existence of a body of copper-gold ore to the northwest of the old gold stopes was discovered, it was decided to carefully prospect it by diamond drilling before any expense was incurred in the erection of a plant to treat this new class of ore. With this object in view 20,000 ft. were drilled and careful assay plans kept of all the work. In making the estimates of the ore developed by this work a graphic method of showing the assays of the bores was utilized in conjunction with the assay plans, is shown in the accompanying diagram.

In calculating the content of the ore reserves, copper was taken at £50 per ton and gold 4s. per pennyweight.

If the percentage of copper is plotted on a 20 scale then a 20 scale will also read its value in shillings. If pennyweights are plotted on a 50 scale, then a 20 scale will also read the value in shillings. A line is drawn to represent the bore; this is divided with a 20 scale into sections of core represented by one assay (generally 4 ft. 6 in.), and lines are drawn through the centers of each of these sections upon which to plot the assays. These are plotted, the copper to the right, and the gold to the left, of the bore line, which is taken as zero in each case. By joining these plotted points a diagram is obtained of the copper contents to the right, and gold to the left, each reading shillings by a 20 scale.

To obtain the total value of the ore, the gold assays are also plotted upon the copper line, using this line as zero. This gives a figure showing the copper plus gold in shillings per ton. Where dikes occur they are of course plotted in their proper place. By drawing lines parallel to the bore line at 30, 40, 50 and 60 from it, a glance will show what lengths of this bore exceed these values. Of course, the average of any section of the

bore can also be obtained from these diagrams by obtaining the area of the section, with a planimeter, and dividing by the length. These graphic representations were useful and by them it was easier to estimate quantities than with the list of values upon the assay plan or in the assay book.

STOPE PRODUCTION CARD

As previously mentioned at the end of each four weeks, a card is prepared, showing the production and value of each floor and stope worked during period. As it was impracticable to weigh separately the ore coming from each floor and stope, the information required to fill in the card was procured as follows:

All ore sent from the mine to the works passes over a weighbridge so the actual tonnage delivered by the mine is accurately known. On the last day of each period, the tonnage in the mine hoppers and lying unbroken in the mine (very little ore is kept broken underground) is estimated. By deducting from or adding to the tonnage actually delivered by the mine, the difference between this stock and that carried from the previous month, the total tonnage broken is obtained. The ore obtained from development work (winzes, drives, etc.) is estimated by its cubic content and subtracted from the tonnage broken, and then the number of sets mined during the period is divided into the remainder, which gives a tonnage per set for the period. As each set is assayed, the average of the assays in each stope of each floor gives the value per ton, and the number of sets the tonnage.

It is evident that errors can occur in this method, as the stock may be under or over estimated, but over a period of, say six months, as the stock is carried forward each four weeks, these errors should balance each other. They cannot be cumulative. Also the contents are obtained on the assumption that each set supplies the same tonnage which, although not individually correct, must be accurate over a period as all the timber is cut in a sawmill to a uniform size. After this card had been completed, but not before, the value of the mine product for the four weeks was compared with the average of the works' daily samples taken after the ore had been crushed. It was the way in which these two estimates of the mine product, obtained from a completely different set of assays, checked that makes me speak so confidently about the accuracy of sampling a deposit like Mount Morgan by borings from machine drills.

Vincent forge was built by William Branson, on French creek in Chester county, Pennsylvania, in 1750. Two or three years later Branson began to make crucible steel, and this is said to have been the first steel made in America.

State Mining Areas of the Transvaal

SPECIAL CORRESPONDENCE

The full text of the mineral lease entered into between the government and Gustav Imroth under the provisions of the Precious and Base Metal Act of 1908 is now published. The lessee, Mr. Imroth, representing Barnato Brothers, has been granted the exclusive right to mine the two government gold-bearing areas of 2633 claims, on the Modderfontein farm on the eastern extension of the Rand.

The lease provides that the lessee shall, on or before Feb. 28, 1910, register a company whose principal object shall be to supply the capital necessary to work the claims. It is provided that the initial capital of the company shall be £1,400,000, £1 shares, of which (1) 175,000 shares shall be offered for subscription to the Transvaal public; (2) 450,000 shares to be paid up in full by the guarantors, Barnato Brothers, prior to registration, and (3) 775,000 shares to be subscribed at par by the guarantors, 2s. per share to be paid prior to registration and the balance as required. The guarantors are also required to take up at par and pay for in full all of the shares offered to the public as may not be applied for. It is, however, unlikely that any of these will be left.

Upon the registration of the company the lessee must assign and transfer to such company free of all consideration all his right, title and interest in and to this lease. The lessee, or the company, must not create nor issue any vendor's, guarantor's or promoter's shares, nor shall he or it pay any underwriting or other commission in the acquisition of the lease or of the provision of the initial capital of the company, and none of the shares of the company are to be issued below par. Operations must be commenced not later than June 1, 1910, unless the Minister of Mines consents to a postponement.

In consideration of granting the above rights the government receives, (1) a tax on the net produce of the mine that shall bear the same ratio to the net produce as the latter bears to the value of the precious metals produced, subject to a minimum of 10 per cent. and a maximum of 50 per cent.; and (2) a further amount computed as follows: when the prime tax does not exceed 20 per cent. of the net produce, $7\frac{1}{2}$ per cent.; exceeding 20 per cent. but not $33\frac{1}{3}$ per cent., 10 per cent.; exceeding $33\frac{1}{3}$ per cent., but not 49 per cent., $17\frac{1}{2}$ per cent.; exceeding 49 per cent., $22\frac{1}{2}$ per cent. The lease endures until the profitably treatable mineral has been exhausted. The scheme is one of the most interesting yet brought forward in gold mining.

Notes on the Zeehan Mining Field, Tasmania

Tin-Silver-Lead Deposits of Cambrian Age. Montana Mine Has Paid \$750,000 in Dividends. Large Percentage of Ore Mined by Tributers

BY GERARD W. WILLIAMS*

The metal-mining fields of Tasmania are all within a comparatively small area in the northwest portion of the island. The tin-lead-silver deposits are due to the presence and influence of the Heemskirk granite *massif*. The genesis of the metaliferous lodes of this area has been clearly shown in the numerous bulletins issued by the government geologists. Few districts in Australia have been more carefully studied and the work of the government geologists has been of great importance from an economic and scientific standpoint.

The entire metalliferous area is rugged and the hills are clothed with heavy timber, interlacing vines and shrubs. The rainfall varies from 120 to 200 in. per annum. The flats are mostly peat bogs covered with tufts of button grass. For many years the middle west and northwest of the island was regarded as an utter waste, and at the beginning of the last century the great penal settlement of Port Macquarie, on the west coast, was chosen for that reason. The penal settlement was abandoned in 1833 and the whole district remained practically unknown for 40 years. In 1871 the Mount Bischoff tin mine was discovered, and pushing out from this center the prospectors opened up the Heemskirk tin fields in 1877 and entered the Zeehan district in 1882. The Mount Lyell field first attracted attention in 1881 as an alluvial goldfield, not as a copper-mining district. Since then many new fields have been opened around Zeehan.

CAMBRIAN AND SILURIAN ROCKS

Without exception all the important ore-bearing rocks of Tasmania are of Cambrian and Silurian age. It appears quite certain that the mineralization of these rocks, for the most part sedimentary in origin, took place during the period of great earth movement that characterized the Devonian age in Tasmania and the adjoining mainland. No sedimentary rocks have been found which can with certainty be referred to this period, as the faulted, shattered and metamorphosed Paleozoic strata are overlain by Permian-Carboniferous or younger rocks. The greater portion of the island is overlain by coal-measures. The central portion is covered by post-Devonian flows of diabase and basalt. Consequently the mineral areas are limited to that portion where denudation has exposed the underlying rocks, or which have remained

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above water since the commencement of Mesozoic time. The small mineralized area is still far from being thoroughly prospected. The natural difficulties are so great, the covering of trees and scrub so dense that it will be many years before the country even in the immediate vicinity of the existing camps is fully examined.

ANTICLINAL FOLD

The rocks of the Zeehan silver-lead field are composed of a basal series of conglomerates overlain conformably by slates, sandstones and interbedded tuffs and melaphyres. The slates are referred to the upper Silurian. A vast anticlinal fold traverses the country north 45 deg. west. The Zeehan mines lie to the north of Mount Zeehan, which represents the eroded crest of the anticline. The lodes are situated in the slates and melaphyres which, subsequent to their first folding, have undergone considerable faulting. The richest lodes are in the most disturbed country.

The entire area has undergone extensive denudation since mineralization of the fissures took place. The present lodes are but the roots of the original fissures. Seven miles to the westward the big Heemskirk granite *massif* outcrops, and as the ore deposits are traced towards the contact, the change both in vein formation and mineral contents is marked. Although most of the Zeehan lodes are true fissure veins, they are frequently subdivided and broken as they approach the series of cross faults that run diagonally across the usual north and south line of the mineral-bearing lodes and exhibit a general "drag" along the lines of earth movement. In many cases there appears to have been a period of secondary enrichment of the fissures along the line of the cross faults.

TYPES OF DEPOSITS

There are several types of deposits, the most important being:

(1) The magnetite type: These lodes are found in the contact country around Mount Heemskirk and do not properly belong to this district. Cassiterite, galena and blende occur in these veins, but so far they have not proved of any great commercial importance.

(2) The pyrite-cassiterite type: A small lode occurs on one of the most westerly of the Zeehan mines, but several similar lodes have been worked in the district. At present several mines in the Dundas district, a few miles northeast of

Zeehan, are opening up on similar lode formation.

(3) The preceding types pass into the magnetite-blende-chalcopryrite-galena-pyrite type. Several of these lodes occur in the Comstock district, four miles west of Zeehan.

(4) The pyrite-galena-blende type which is strongly represented on the western portion of the field. The Oonah mine furnishes a good example of this variety of lode.

(5) The siderite-galena type: This is the most important type on the Zeehan field. The lodes on the Montana mine, which will be described, are perfect examples of the type.

(6) The pyrite-stannite-chalcopryrite type: This interesting type occurs on the Oonah mine and in a neighboring mine similar ore occurs in association with blende and galena.

As the country is traced away from the central granite mass these types overlap and pass gradually from one type to another. The general order of the lodes in relation to the granite contact is well shown in the accompanying diagram compiled by G. A. Waller, assistant government geologist. Varied as these lode formations are they yet seem to possess one common basis of similarity, for so far ore from below 550 ft. in depth has not repaid the cost of development. Few veins extend deeper than 250 ft. The majority have not paid to work below water level. Unfortunately the country rock yields much water, and this fact has certainly militated against exploration in depth.

At present only two mines of importance are working: The Montana and the Oonah, and as each of these mines represents a different type of vein matter a description of the two mines furnishes in effect a description of the leading features of the field. The other mines are given over to tributers; indeed, the bulk of the ore from this field has been mined either by tributers or by small parties of working miners.

THE MONTANA MINE

There are about eight lodes on the property, all of which have been worked more or less. The chief producer is the No. 2 lode, and for the present all development work is confined to this orebody. The lodes are true fissure veins running in a general north and south direction and dip east at an average angle of 65 deg. The lode fissures traverse slates and melaphyres alike

without being in any way affected by the nature of the country rock. The most important feature in the mine is the Big Slide, which runs diagonally across the country striking 60 deg. west of north.

THE BIG SLIDE

The Big Slide may be described as a zone of crushed and rolled country 150 ft. wide, at the junction of black slates and grayish melaphyre rock. Throughout the mine there are several parallel normal faults, but none of them attain large dimensions. As the lodes approach the Big Slide they become broken up and exhibit a marked drag to the westward along the line of earth movement. The crushed country in the fault itself has yielded small patches of ore, but nothing payable has been found in the disturbed country. The lodes, on the other hand, are all enriched in the vicinity of the faults, and particularly in the neighborhood of the Big Slide. Recent development has shown that the No. 2 lode exists north of the fault and important ore-bodies are now being opened up. Two distinct types of galena can be distinguished in the vicinity of the faults, a cubic form and a dense, finely crystalline variety. In places where the lode expands to a few feet in thickness, the face of the orebody exhibits a concretionary structure, with concentric rings of galena and siderite alternating. The surface ores exhibit none of the ordinary characteristics of secondary enrichment by oxidation, the galena extending to the grass roots. In lodes occurring in the hills there is usually a capping of argenterous gossan. The zone of lead carbonates is usually absent. It has been suggested that the peaty waters, which carry humic acid, have effected some concentration of the lodes on the low-lying portions of the field. It is difficult to find direct evidence of this. Pyrite is entirely absent in lodes of the Montana type. I am inclined to the view that the obviously secondary appearance of the richer portion of the lodes was due to a second phase of subterranean enrichment proceeding along the line of the later series of faults and crushed zones.

On the south side of the Big Slide the eight lodes have been carefully explored and 32 miles of development work testifies to the thoroughness with which prospecting was carried out. In the 800-ft. workings, and 1000 ft. in the adjoining Spray mine, the vein formation of siderite persists unchanged, but the metal contents are either wanting altogether, or scattered. On the north side of the Big Slide there are indications that the metal contents will extend to a greater depth on the footwall of the slide than was the case when the lodes were followed down under the hanging wall.

The lodes on this mine and of the district in general are similar in nature and occurrence to the older series of lodes

in the Freiberg district (Saxony). There are four main types on the latter field: The Noble quartz; the pyritic lead and copper; the tin, and the siderite or Noble lead formation. The first type does not occur in Zeehan, but examples of this type may be found at Mount Farrell, 20 miles distant. The other types occur. The tin deposit is being represented only by a small pyrite-cassiterite vein recently found on the surface of the Oonah lease. The presence of blende in the pyrite deposit and the absence of it in the sideritic veins is common to both fields, as is also a fact that the silver-lead ratio is higher in the sideritic than in the pyritic galena. The pyrite-stannite lodes of the Oonah have no analogue in the Freiberg series.

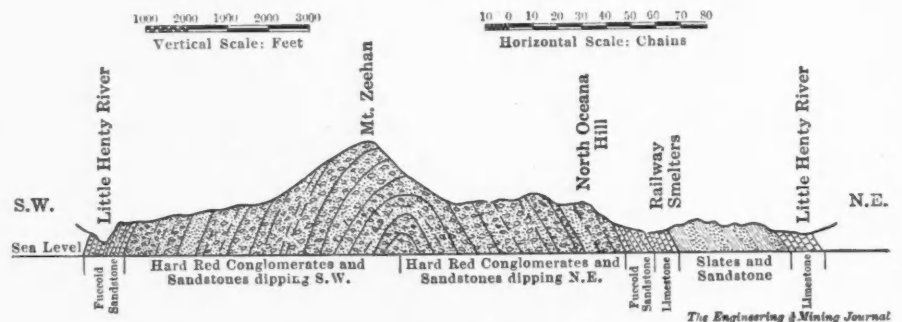
MINING METHODS

The vein varies in width from a few inches up to two feet, the siderite filling being constant throughout. The galena occurs in the form of irregular masses lying within areas which exhibit a definite relation to the cross faults. In

250 tons of concentrates, containing 65 per cent. lead and 70 oz. silver per ton. The men employed in the mine average 250 in number, of whom 40 are on development work. Starting with an actual capital of \$15,000, the mine has about 40 miles of development work on the main and subsidiary leases, a modern mill, and has paid \$750,000 in dividends.

METALLURGICAL WORK

The ore from the mine is dumped on a $\frac{7}{8}$ -in. grizzly, the oversize passing to a jaw breaker which delivers to a $\frac{7}{8}$ -in. trommel. The undersize from this, together with the undersize from the grizzly, passes to a $\frac{1}{2}$ -in. trommel. The oversize from the latter, together with the oversize from the $\frac{7}{8}$ -in. trommel is sent over a picking table, where it is hand picked by boys. About 2 per cent. of the total ore is removed in the form of 60 per cent. "firsts," and 12.5 per cent. is cast aside for waste. The balance goes to the coarse rolls, where it is joined by the undersize from the $\frac{1}{2}$ -in. trommel, which has previously passed over a two-



GEOLOGICAL SECTION THROUGH MOUNT ZEEHAN, TASMANIA

view of the irregular deposit it is necessary to stope the entire vein. Frequently a level will show no trace of metal and a stope may be carried half way up to the next level before ore comes in. The ore is hand-picked in the mine into "firsts" and milling ore; the residual siderite and country rock are used for filling. The stopes are worked on the flat-back system, and owing to the flaky nature of the slate hanging-wall they are carried 6 ft. wide. Little timber is needed, as the filling is kept well up to the face. The mine yields 28,000 gallons of water per hour.

WAGES

Miners receive \$2 per shift; truckers on contract average \$1.92; timbermen \$2.10, and engine drivers \$2.30 to \$2.40. The standard of mine labor on this field is high and compares more than favorably with the best Australian labor. Although there is no official preference for union labor, few non-union men are employed.

The mine produces 150 tons of picked "firsts" per month. The picked ore averages 70 per cent. lead, and 65 to 80 oz. of silver per ton (2240 lb). In addition 1800 tons are sent to the mill, yielding

hutch jig for the removal of a coarse concentrates.

The rolls are 14x24 in., set $\frac{1}{2}$ in. apart. They run at 40 r.p.m. From the coarse rolls the ore passes through a series of trommels with circular holes, 13, 9, 5, 3, and 1.6 mm. in diameter. The ore is therefore graduated into six sizes: (1) Over 13 mm.; (2) between 9 and 13; (3) between 5 and 9; (4) between 3 and 5; (5) between 1.5 and 3, and (6) less than 1.5 mm. in diameter.

For these products 1 returns to the coarse rolls; 2 passes to a two-compartment jig, the tails returning to the fine rolls; products 3, 4 and 5 pass each to a three-compartment jig; the tails go to waste, but the product from the second and third compartments is elevated to the fine rolls; and 6 goes direct to a hydraulic classifier.

The fine rolls are of the same size as the coarse rolls and run at the same speed, but are set close for friction drive. The product from the rolls passes a 4-mm. trommel, the oversize returning to the fine rolls. The undersize passes a 3-mm. trommel, the oversize being sent to a three-compartment jig. The tails are

rejected and the product from the second and third compartment returned to the rolls. The undersize from the 3-mm. trommel passes to a 1.5-mm. screen and is classified as in the case of the 3-mm. product. The final undersize is sent to the hydraulic classifier. The latter distributes the fine sands over three Wilfley tables and a Cornish buddle. The middlings from the tables are returned to the classifier.

THE OONAH MINES

The leases held by this company are situated on the northwestern portion of the Zeehan field and the characteristics of the lodes are intermediate between the Montana siderite-galena type and the contact lodes of the Comstock-Heemskirk districts. There are three distinct types on the property—the pyrite-galena-blende, the copper-pyrite-stannite type and the pyrite-cassiterite type.

The galena lodes have been worked out several years. The main galena lode has a strike a few degrees west of north and dips at a steep angle to the east. In the north the lode terminates against what is

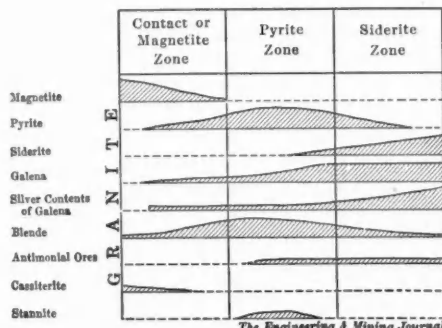


DIAGRAM OF MINERAL DISTRIBUTION OF ZEEHAN LODS

either a continuation of the Big Slide in the Montana mine or a parallel movement of a similar nature. As in the latter mine, the lode drags to the west when it comes up against the zone of faulted country. To the west of the main lode a smaller and similar lode was worked. Neither of these lodes were profitably worked below 400 ft. in depth.

The Stannite lode is at present the most important ore deposit in the mine. In addition to stannite, the pyritic gangue of the vein carries appreciable quantities of wolfram, bismuthenite and silver. A picked parcel of 70 tons taken from the upper workings gave 10.7 per cent. copper, 9.2 per cent. tin and 65 oz. of silver. The Stannite lode has been opened 425 ft. in depth and is found to maintain its average ore and width. In width the vein varies from a few inches to 3 ft. and since the present company started work the ore has average 6.5 per cent. of copper, 3.5 per cent. tin and 30 oz. of silver per ton. It is interesting to note that although wolfram is coming into the ore in depth, cassiterite has not yet been identified in the Stannite lode.

The company is vigorously opening up the Stannite lode and is erecting reduction works capable of treating 80 to 100 tons per day. Another lode, now abandoned, was worked for the rich kaolin cap which carried much silver. In another of the many small lodes in this mine, which have mostly been worked by tributers, the pyrite gangue carried payable quantities of argentite and pyrrargyrite.

Another lode, at present mined and concentrated for pyrites, carries about 0.5 per cent. of copper. This lode is worked by tributers. They concentrate the ore, which averages 35 per cent. FeS₂ and ship the concentrates to Melbourne for use in the sulphuric-acid plant. Recently the outcrop of a small pyrite lode was discovered; the vein carries cassiterite and a little chalcopyrite.

METALLURGICAL TREATMENT

The plant consists of a 70-ton, water-jacket blast furnace built with a 30-ft. ore column; a reverberatory furnace; two Leggo roasters and the usual crushing plant. The metallurgists engaged upon the work have had many difficulties to contend with, but it seems almost certain that they have at last evolved a satisfactory treatment. It has been found that by sintering the ore and reducing the sulphur from 27 to about 8 per cent. and then smelting in a high-column furnace the losses due to the volatilization of tin are reduced to a minimum, and that a 2.5:1 concentration of the tin, copper and silver may be effected without undue slag losses. The matte, after crushing, is roasted in the Leggo furnace and treated in the reverberatory together with picked ore from the mine. The latter will average 8 to 10 per cent. copper and 6 to 7 per cent. tin, as against the smelting ore of 6.5 per cent. copper and 3.5 per cent. tin. By bottoming the major portion of the copper, the bulk of the silver is removed and the slag carrying all the tin and some of the copper can be profitably re-treated in the blast furnace. As a result of this cycle of treatments the management expects to market argentiferous black-copper and tin-copper bullion, small amounts of bismuth-tin-copper alloys which form in the blast furnace.

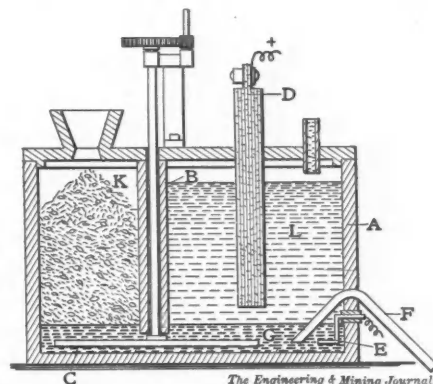
New Mining Law in Spain

The new mining law provides that every proprietor of mines shall submit to the treasury at the end of each three months a detailed report on the output of his property. This report is to particularize as to quantity and quality of the output, and its value, based on the average selling prices quoted during the quarter. A tax of 3 per cent. on the value of the output is then calculated. The mine owner has to sign the declarations required.

Metallic Lead from Galena by an Electrolytic Process

A process for the electrolytic separation of metals from their ores, but especially in connection with the production of metallic lead from galena was patented (U. S. pat. 941,904, Nov. 30, 1909) by Herbert S. Auerbach.

In the accompanying illustration is shown an apparatus suitable for carrying out the process. The vessel A, made of, or lined with, fire clay is provided with



APPARATUS FOR PRODUCING ELECTROLYTIC LEAD

a cover having a funnel, and extending through it is a tube for the escape of sulphur fumes and gaseous compounds. A partition B, reaches almost to the bottom of the vessel, and in this partition is a shaft with a pinion and gear at the upper end for revolving it. At the lower end is a spider C. D is the carbon electrode and E is the other. F is a siphon, to draw off the molten lead.

Metallic lead G, is placed in the bottom of the furnace, the ore in the compartment K, and heat applied to melt the lead. The ore partially dissolves in the molten lead which acts as a collector. An electrolyte, L (which may consist of almost any haloid salt of the alkali or alkaline earth metals) is now added and fused by heat. An electric current is passed through the molten liquid from the carbon D, to the electrode E; the halogen gases are freed, while aluminum, sodium, calcium or potassium (depending on the bath employed) is liberated from the electrolyte and forms an alloy with or is dissolved in the molten lead. The liberated metal or metals combine with the lead sulphide in solution or alloyed with the metallic lead, forming sulphides of the attacking metals and reducing lead sulphide. The new sulphides formed are decomposed by the electric current, the sulphur going off as a gas, while the liberated metals or metals of the alkali or alkaline earths again attack the lead sulphide and the process as described is repeated. Metallic lead is thus continuously produced and sulphur is distilled off at the surface of the electrolyte.

Growth of American and Australian Mining Law

American Law Evolved from Experience in California after Rush of '49; Leasehold System Proved Superior to Freehold in Australia

B Y A . C . V E A T C H *

The discovery of workable alluvial gold in California in 1848 marks the beginning of American mining law, and in like manner a similar discovery in Victoria and New South Wales in 1851 marks the beginning of Australian mining law. To link these countries even more closely, it may be noted that the opening of the Australian goldfields was due to the return of persons who had been attracted by the California rush and their application to the Australian fields of the knowledge gained in California. Victoria, furthermore, with only three-fifths of the area of California, has today nearly the same population, and between 1851 and 1905 produced gold to the value of \$1,365,000,000, while California produced between 1848 and 1905, \$1,400,000,000. The Victoria gold production in 1905 was about \$16,000,000, while almost \$19,000,000 was produced in California.

INAUGURATION OF FREEHOLD SYSTEM

Previous to these discoveries, in both America and Australia, several more or less abortive attempts had been made at mining legislation. In each case some of the early grants contained reservations of certain minerals, others did not. In America an attempt had been made at leasing lead- and copper-bearing lands, and in 1845 President Polk recommended the abolition of this system and the selling of the lands outright. This recommendation was followed by the acts of July 11, 1846, as regards the lead of the Mississippi valley; of March 1, 1847, as regards the mineral lands of the Lake Superior land district in Michigan; and of March 3, 1847, as regards the mineral lands in the Chippewa district of Wisconsin. The minimum price fixed for these lands was \$5 per acre.

In 1840, in like manner, the British Secretary of State, Lord Russell, announced his opinion in a letter to the Governor-in-chief of New South Wales, Van Diemen's Land and their dependencies, as follows: "All deeds of grant throughout the whole of the colony should henceforth convey to the purchaser everything below and everything above the surface. Neither would I reserve lands merely because supposed, or even certainly known, to contain useful mineral substances. The small amount of profit derived from mines throughout the great extent of the British colonial empire would appear to us sufficient rea-

son why such reservations would, as a general rule, be as unnecessary as they would be inconvenient to the progress of the settlement."

And the Land Regulations of the colony, dated March 1, 1843, contains the statement that "all deeds of grant from the Crown will be issued . . . conveying all that is above and all that is beneath the surface," except that in certain areas coal will be reserved until 1862, and that "precious minerals or metals may also be reserved if it be known that they greatly abound, but not otherwise." In 1846 an attempt was made in South Australia and Western Australia to reserve to the government one-fifteenth of all metals and ores containing metals, and to issue mining leases at this royalty of $6\frac{2}{3}$ per cent. This was of particular importance in South Australia because of the copper mines which were then being developed there, and here again a close parallel is found in American history in the copper leases issued in the Superior district between 1843 and 1846 at a royalty of 6 per cent.

In 1849 this plan was abolished and an act was passed in South Australia waiving the reservation contained in all grants previous to that date. In February, 1850, the governor of New South Wales issued a proclamation declaring that the reservations of coal contained in certain grants before that date were forever abandoned. Mineral lands were sold throughout Australia in much the same way as other lands, and at a minimum price of £1 per acre.

It thus happened that in both the United States and Australia at the time of the discovery of gold the governments had abandoned both the plan of reserving minerals in deeds of grant and of such mineral areas as were found under much the same conditions as other lands. In America the abolition of any system of mineral leasing or reservation was recommended by President Polk because of the difficulty of collecting rents, the cost of administering the system and the irritation of the people. In Australia the matter was placed on the rather broader grounds that the development of the country would be promoted by such a change.

NO LAW IN CALIFORNIA IN '49

Had only small amounts of gold been found there is little doubt that such auriferous lands would have been sold in the same way as other lands, as had

been done in South Australia some years before, and that in time a system of mineral-land law would have been gradually evolved which would have had little in common with the present American law, and which might or might not have resembled the Australian law. But in both America and Australia the discoveries were not small; they were of such enormous magnitude that they made the whole world pause, and resulted in two of the most stupendous gold rushes ever known. Both California and that portion of southeastern Australia where gold was found, including portions of New South Wales and Victoria, were thinly settled regions, and the influx of an enormous population, gold-mad, at once produced a crisis. The new population many times exceeded the old, and, as many of the older residents holding positions under the Government resigned their offices and joined the gold-seekers, the preservation of law and order became a serious matter.

In California the discovery of gold followed on the heels of the Mexican war. The district where the gold was found was under military government, and it continued to be so governed until the admission of California into the Union in September, 1850. The region was far from the seat of Government, communication was slow and uncertain and the whole future course of the mineral law for many years, as it has proved, depended upon the action of the man on the spot. This man, Colonel Mason, proclaimed on Feb. 12, 1848, that, "From and after this date the Mexican laws and customs now prevailing in California relative to the denouncement of mines are hereby abolished." This proclamation, so far as this region was concerned, did away with whatever vestiges of mining law then existed and left Colonel Mason free either to promulgate and enforce adequate provisions, having for their object the safeguarding of the future interests of the community, or to allow the miners to "fight it out among themselves." Colonel Mason visited the fields and was so appalled by the magnitude of the task before him that he announced:

"It was a matter of serious reflection with me how I could secure to the Government certain rents or fees for the privilege of procuring this gold; but upon considering the large extent of country, the character of the people engaged and the small scattered force at my com-

*Geologist, U. S. Geological Survey, Washington, D. C.

mand, I resolved not to interfere, but permit all to work freely."

Thus did Colonel Mason fail utterly to meet the great emergency with which he was confronted, and there followed a period of excess, crime and lawlessness which forms a disgraceful episode in our national history. Left to themselves, the miners were forced to form local organizations and vigilance committees for the administration of a rude justice and for the partial preservation of order. Each locality promulgated certain evident regulations regarding the right of a discoverer to a claim, and the essential condition of development as the necessary requisite for the retention of title. These primitive and fundamental mining-law conceptions, which spontaneously assert themselves in all regions when the demand arises, were soon followed by other regulations of a more local or special application.

ORIGIN OF EXTRALATERAL RIGHTS

The most important of these special regulations, and the one which has exerted the most far-reaching effect on the mining industry of the United States, is that relating to extralateral rights, whereby the holder of the apex of a reef is considered to be entitled to all the underlay of the reef within the extension of his end lines. This is a distortion of the right of the discoverer, and originated under much the same conditions as that other impossibility of American mining law, the assertion that only a discovery can initiate the right to a mining holding.

Both these doctrines naturally found expression in the Australian mining law, but Australia, after giving both a careful test, abandoned them and herein is illustrated the basic difference between American and Australian in the matter of mining legislation. Starting from the same point and based on the same fundamental principles, developing along the same lines and under much the same conditions, the American law is essentially where it was over 50 years ago while the Australian laws have been progressively improved. After fair trial, the Australians have rejected what was bad and have produced enactments which much more fully protect the rights of all concerned than those which are today found on American statute books.

Whatever may have been the original utility of the discovery and extralateral-right provisions, the need of such provisions has long since passed. The discovery doctrine has been responsible for more essentially false declarations than probably any other enactment on the American statute books. The extralateral-right doctrine has resulted in an endless amount of litigation, involving the absolutely unproductive expenditure of millions, and, unless firm and decided action is taken at this late day, the end is not yet. Fully realizing the difficulties

which beset any endeavor to undo the harm which has been done, it is confidently believed that an entirely equitable solution of this difficulty can be propounded. All the leading mining men in Australia with whom the matter has been discussed regard the matter susceptible of such a solution.

The Federal Government followed the policy of Colonel Mason, and did nothing. The matters which led up to the Civil War were then of overshadowing importance, and the affairs of the distant State of California seemed of small moment in comparison. The war followed, and it was thus almost twenty years before any action was taken by the National Government relative to mineral-land laws. The enactment of 1866 did little more than legalize whatever customs or regulations might be found locally agreeable after that date, provided they did not change the more fundamental of those which had been already established and incorporated in the law. The majority of the western Congressmen were at this time, as now, strong, able men, interested in and benefitted by the existing state of affairs, and unwilling or unable to look at the matter in any way than from the standpoint of their own selfish ends. Such is the origin and essentially the present condition of the mining law in the United States, for the Act of 1872 did not materially affect the underlying principles enunciated in the Act of 1866.

COMMON LAW RIGHT OF THE GOVERNMENT

At the time of the discovery of gold, New South Wales and Victoria were, measured in the time required for the journey, but little further from the seat of government in London than California was from Washington. In New South Wales and Victoria there were partially elective legislatures but the Governor was all-powerful, and the conditions of autocratic administration found in California was paralleled by those in these colonies. In New South Wales the existing order of affairs had been established for over half a century, and there was in existence machinery for the administration of justice based on the English law. In the Victorian portion of the colony this had been true for only 15 years, but, while this gave an advantage not found in the Californian situation, the presence on the goldfields of large numbers of convicts who had been transported to Tasmania and New South Wales gave rise to a state of affairs which, so far as the preservation of order was concerned, certainly equalled, if it did not exceed in lawlessness that in California.

The matter here, as in California, resolved itself into a question of the power of the man on the spot, and in Australia the man for the task was not wanting. While recognizing that the existing force was entirely inadequate to cope with the

emergency, Governor Fitzroy, of New South Wales, which then included Victoria, did not follow Colonel Mason's example and let the men fight it out among themselves, but said in effect: "Order must be preserved, and if the preservation of order requires a larger force and a greatly increased expenditure, it is but right that those who will be most protected and benefited (the miners) should pay for it." This reasoning led to the first two acts of goldfield law in Australia—the issuing by Governor Fitzroy of a proclamation on May 22, 1851, and of regulations covering gold-digging licenses on the following day.

This proclamation asserted the common law right of the Crown or Government to "all mines of gold and all gold in its natural place of deposit . . . whether on the lands of Her Majesty or Her Majesty's subjects," and warned all persons that anyone removing any gold, or digging for or disturbing the soil in search of such gold, without being duly authorized, would be prosecuted both criminally and civilly, and notified all persons that "such regulations . . . as may be found expedient will be speedily prepared and published, setting forth the terms on which licenses will be issued for this purpose."

This assertion of the common law right of the Government to all precious metals, while correct in law, was clearly an emergency proceeding, as it was in direct violation of the principles which had been announced in Lord Russell's despatch of 1840 and in the Land Regulations of New South Wales of 1840 and 1843. It might be pointed out that a similar proclamation was possible in California without evoking the common law right of the Government if Colonel Mason had desired to avoid it, because practically all the gold was obtained from public lands, and the remainder was entirely from Spanish grants in which the precious metals had not passed to the freeholder. The matter thus lay even more fully in the hands of Colonel Mason than it did in the hands of the Governor of New South Wales. There was in the United States at that time no law providing for free search on public lands, and the "diggers" were, as in Australia, legally trespassers.

HIGH MINING FEES EXACTED

On July 1, 1851, Victoria was formally separated from New South Wales, and on Aug. 15 and 18 Lieutenant-governor Latrobe repeated the proclamations and regulations issued by Governor Fitzroy the preceding May. Those in New South Wales seemed to have been rather better suited to the needs of the case than those of Victoria, and were received with much more general satisfaction by the "diggers." In April, 1852, Governor Fitzroy visited the diggings, and everywhere he was thanked by the miners for the tran-

quill and prosperous state of the extensive gold-bearing districts, which was due, in their opinion, to the wise goldfield regulations, to the police force established and to the care evidenced by the Government in maintaining order. New South Wales was at this time producing several million dollars more gold per year than is now being obtained from Alaska, and the situation offers a striking contrast to the early days in California and one which does not redound to the credit of the United States.

In Victoria, which was the center of the excitement, the early period was not passed so successfully. While this may have been due in part to the greater magnitude of the operations (Victoria was then producing over £200,000 of gold per week), it seems to have been due more to certain ill-advised regulations, to opportunities which these regulations opened up for blackmailing and grafting on the part of some of the petty officials, and to the misconduct and misjudgment of some of these officers. The regulations of Aug. 18, 1851, which became effective on Sept. 1, and which fixed the license fee at the considerable figure of 30s. per month, were followed on Dec. 1 by new regulations increasing this fee to £3 per month, and requiring that every person on the goldfields, including cooks and teamsters, should pay the fee.

This raised a storm of protest and seems to have marked the beginning of the feeling of discontent, which, fed by one official act or another, culminated in the Ballarat riot of 1854. Following the proclamations of the regulations of Dec. 1, 1851, thousands of men assembled, and with decency and order passed resolutions which led to the immediate revocation of the objectionable regulations.

FINES FOR UNAUTHORIZED MINING

During the following summer the partially elective legislative council passed an act to restrain by summary proceedings unauthorized mining on the waste lands of the Crown. In this act there is the first evidence of special tribunals for the decision of mining disputes; provision is made for the appointment of certain officers called gold commissioners, who were empowered to inquire into disputes between miners and determine them in a summary way. This act provided that any person found mining or digging for ore should be liable to a fine, but expressly stated that nothing in the act should be construed to extend to any preliminary search or inquiry for the purpose merely of discovering ore or minerals. This provision was undoubtedly intended to relieve the unsuccessful prospector from the payment of the license fee, but the police did not so interpret it and demanded that every person found on the goldfields should have a license.

As the police received half the fines, there commenced the practice of "digger

hunting," which was carried to such an extent and with so many evidences of rank injustice and of collusion between police officers and magistrates, that the matter became one of very serious import to the miners. Another fertile source of discontent lay in the fact that the gold commissioners appointed were mere youngsters of good families, with entirely erroneous ideas of their duties and prerogatives, and, while some of them afterward made good wardens because of the experience gained, their conduct during this critical period was often far from commendable.

The license fee not yielding the protection of their rights for which it was in theory assessed, was regarded by the miners as an odious tax. This feeling of discontent was intensified in the autumn of 1853 by the reduction of the license fee to 10s. in New South Wales, when it was found that the receipts more than met the expenses; and judging from the fact that the fees from gold-diggers' licenses are reported to have amounted to as much as £700,000 per year at this time, it would seem that Victoria might have done likewise. Public opinion was crystallized in the autumn of 1854 by the discharge by a local magistrate of a notorious personage, who had been guilty of many crimes and who had boasted that the magistrate would not convict him, and by the imprisonment of three innocent miners in connection with the case on the perjured evidence of the police officers. A mass meeting was held, at which resolutions were passed demanding the release of the miners. Governor Hotham, who had succeeded Lieutenant-governor Latrobe, was a high-strung navy officer, accustomed to implicit obedience, and not only refused the "demand" but sent soldiers to the spot to enforce order. This led to the inevitable conflict and resulted in the death of 25 miners and 5 soldiers.

THE "MINERS' RIGHT" ESTABLISHED

This Eureka stockade affair led to the immediate appointment of a Royal Commission to investigate the matters at issue. The report of this commission on March 29, 1855, resulted in the passage, the following June, of a new Goldfields Act, which marks the beginning "of practical legislation, having for its object the advancement of mining, the improvement of the position of the men and the collection, by methods least likely to be burdensome, of reasonable fees for the privilege of mining on Crown lands." This Act of 1855 abolished the license fee of 30s. per month, and substituted for it a document happily called a "Miners' Right," which was issued on payment of 20s. per year.

The act also provided for local courts, composed of a chairman appointed by the Governor, and nine holders of miners' rights elected by the miners of the

district. These local courts were empowered to frame regulations in the nature of by-laws to regulate the taking up and working of claims and the settlement of disputes between miners. Five mining districts were created in this year, each of which had its own local court. The gold commissioners were replaced by officers called "wardens," who, with the abolition of the judicial feature of the local courts in 1865 and the reorganization under the name of "mining boards," became very important officials in the administration of the mining law.

This act marks the end of the disturbance on the goldfields. These troubles were primarily conflicts between the miners and the officers of the law, not through the lawlessness of the miners, but through the indiscretions and injustices of the officers of the law, and are to be viewed in a different light from the disturbances in California. One is quite ready to agree with the statements contained in the despatches of Governor Latrobe to the Colonial office in London, that the conduct of the greater number of miners was deserving of all praise, and that life on the goldfields was far more orderly than the precedent of California might have led him to expect, and to indorse the following summary of the matter made in 1869 by a leading Victorian mining man:

"But for the prompt action of the Governor . . . it is certain that a repetition of the atrocities which disgraced California would have been seen in our colony." Changes were made from time to time as new needs arose, and with the passing of the shallow alluvial gold period, the need of a further fundamental change in the law became evident. Another royal commission made an extensive study of the matter, and the Mining Statute of 1865 resulted. This is by many regarded as the mother mining act of Australia.

The enormous developments in Victoria between 1851 and 1865 were certainly, under wise supervision, calculated to develop and fully test a practical mining law, and the Victorian Mining Act of 1865 has therefore taken a foremost place among Australian mining enactments, because it was based on the most experience. Victoria continued its premier position as the principal mineral-producing district in Australia for many years, and during these years the chief judge of the Court of Mines, Robert Molesworth, a man of strong and forceful character, laid in his decisions the broad foundations of Australian mining law and practice as it exists today. Speaking in 1897, Sir Samuel Griffith, then chief justice of the Supreme Court of Queensland and now chief judge of the High Court of the Australian Commonwealth, said: "It is a well known fact that the mining law of Australia was practically made by the decisions of Justice Moles-

worth and the Supreme Court of Victoria."

AMERICAN LAW REPUDIATES FIRST PRINCIPLES

One of the first-recognized and fundamental principles of both the American and Australian mining laws was that no claim could be held without development. It was considered but fair that if one man did not work the ground another should be permitted to do so. This was not due to any abstract theorizing in the realms of political economy; it was a doctrine which appealed to all men as fair, and one which was not more firmly held in Australia than in America. In America, however, this fundamental idea was soon lost sight of, and became obscured by other considerations.

The conclusion so evident in the early days of the gold rushes, that a man could constantly work only one claim, was obscured by the introduction of capital, whereby the labor condition on many claims could be fulfilled by hired workmen. This led to the provision that any person could hold any number of claims, and when, after the subsidence of the first excitement, the remaining holders agreed among themselves regarding a modification of the condition of continuous development, and there resulted an expression of the development condition in money per year which made it possible for a speculator to hold any number of claims, the result was but little short of the absolute abandonment of the original idea. The final step in the absolute negation of this fundamental principle was taken when it was provided that at the expiration of five years a holder could purchase the fee simple.

A freehold, as applied to mining, means the waiving of the fundamental condition of development for all time. Starting from a common-sense basis which spontaneously appeals to all men, the American mining law developed amid scenes of the wildest description, and was so distorted to meet entirely selfish ends that when the Government finally concluded to do nothing more than recognize this product, it had practically repudiated the principles from which it had sprung.

Australia, on the other hand, has logically followed out the principle thus forced upon it by the necessities of the gold rush of the 50's. It has continued to hold *bona-fide* development, i.e., the reasonably continuous labor of one man for each one man's ground contained in a claim, as the essential condition for the retention of title. It has not reduced this condition, as has been done in America, to such a point that a man can even fully comply with the letter of the law and yet hold a claim without real development.

When the growth of the mining industry showed the necessity of some form of tenure other than a claim, the lease fol-

lowed as a logical result. Only under leasehold tenure is it possible to enforce the condition that "if one man will not work the ground, another should be permitted to do so." This is not Government ownership in the abstract sense, it is only the Government guaranteeing the exercise of a right which miners have asserted in all free countries. Starting at the same point, and from the same basic conception as the American law, the Australian law developed under conditions of order, and the result represents the combined efforts of miners, business men and statesmen to frame a law which to the greatest possible degree would conserve the rights of the miners, the prospector and the developer, and yet would fully protect the interests of the country at large.

MINERALS NOT OWNED BY AUSTRALIAN FREEHOLDER

As has been shown, at the time of the discovery of gold in Australia, the Government had abandoned any idea of reserving either mineral lands or the minerals contained in such lands. In 1840 and again in 1843 the Government announced that every grant would convey all minerals. Had deposits of only small consequence been found, and requests been pushed for the waiver of all government rights, such requests, under the conditions existing before the discovery of gold, would doubtless have been granted.

In South Australia, the only colony then known to contain metalliferous deposits of consequence, and where a gold mine had been worked as early as 1846, such a request was indeed made and granted by the House government in 1849, and the Legislative Council promptly passed an act waiving all reservations in previous grants. In New South Wales, of which Victoria then formed a part, coal was the only mineral which had proved of commercial importance, and reservations of coal had from time to time been inserted in grants. In 1850, Governor Fitzroy, evidently in reply to a general request, proclaimed that: "Her present Majesty, being desirous of promoting the welfare of her subjects, has been graciously pleased to direct that all such reservations and the rights incident thereto shall be abandoned." But no definite legislative action was taken in any part of the Australian states confirming the ownership of the gold to the freeholder who held land under a deed of grant without reservations.

This lack of action was apparently due to the fact that outside of South Australia the question of mineral reservations was of little importance, and because the freeholders with deeds of grant without reservations very naturally thought they owned the gold. The feeling in this respect found ample support in the statements in the despatches from the Colon-

ial Land Board to the Secretary of State, Lord Russell, in 1840,¹ in Lord Russell's despatch to the Governor of New South Wales in 1840,² in the provisions in the Land Regulations of South Australia and New South Wales of 1840,³ in the New South Wales Land Regulations of 1843,⁴ and in the despatch from the Secretary of State to the Governor of South Australia in 1845⁵; in all of which the opinion is expressed that grants without reservations convey everything.

Under the circumstances the assertion of the common-law right of the Government to the precious metals "whether in the lands of Her Majesty or Her Majesty's subjects," which was made in New South Wales in May, 1851, and repeated in Victoria in August, 1851, following the separation of the latter from the former, did not pass unchallenged. There were bitter denunciations of this "invasion of vested rights" and the battle was largely fought out in Victoria. In this state the point was of more importance than in any other states, because of the great value of the gold finds and the fact that here none of the early grants contained reservations of the precious metals; indeed no such reservation was inserted until after May, 1873.

In the first case involving this point (Land vs. Hannah) it was decided in February, 1861, that "gold in land alienated from the Crown still belongs to the Crown and does not pass to the grantee." In 1863 (Miller vs. Wildish) it was again held "all gold mines belong to the Crown, and though the Crown may have granted the lands containing them to a subject without reservation, the gold under the grantee's land is not his, and neither he nor anyone else has a right as against the Crown to take it." This matter repeatedly presented itself in the courts for the next few years and was always decided by the Victorian courts in the same way, though the New South Wales courts rendered decisions adverse to the Government.

In 1876 an appeal (Woolley vs. Attorney General of Victoria) was taken to the court of last resort under the English law, the Privy Council, where the decisions of the Victorian courts were sustained in 1877: "A Crown grant does not pass to the grantee royal mines (that is, gold and silver) that may be found under the land included in the grant, unless the intention that such minerals should pass is expressly stated in the grant in apt and precise words"; and the matter was finally settled.¹ The court

¹English Parliamentary Papers, Sess. 1840, Vol. 33, No. 613, p. 11.

²English Parliamentary Papers, Sess. 1840, Vol. 33, p. 395.

³South Australian Government Gazette, Nov. 14, 1840. New South Wales Gazette, Dec. 9, 1840, p. 1327.

⁴New South Wales Government Gazette, March 1, 1843, p. 342.

⁵English Parliamentary Paper, Sess. 1846, Vol. 24, No. 706, p. 50.

here held, in substance, that the expression of opinion in the several despatches of the British secretaries of state, and their instructions to the colonial governors were, in the absence of any specific granting clause in the conveyance, not conclusive, neither were the provisions in this respect in the Land Regulations of 1840 and 1843.

ENGLISH COMMON LAW BINDING IN AMERICA

In this connection it may be pointed out that no conclusive action has ever been taken in the United States conveying the precious metals to the freeholder. Chief Justice Field, in 1861, in the case of *Moore vs. Smaw* (17 California 199), in which this doctrine was not directly involved for the issue could be clearly defined only by the Government becoming a party to the suit, expressed the opinion that the doctrine was inapplicable to American institutions because the right to the precious metals was "the personal prerogative of the British ruler and not an incident of sovereignty." This conclusion, however, was questioned in 1873 (*Gold Hill Quartz Mining Company vs. Ish*, 5 Oregon 194), where the court referred to the principle as conceded that "mines of precious metals belong to the eminent domain of the political sovereign."

Some time before the American War of Independence the English royal family definitely relinquished to the State all public lands and royal mines, and any question which may have remained regarding the exercise by the State (the *de facto* sovereign under constitutional government) of those functions which before the existence of constitutional government were vested solely in the king, were forever settled. The right to the precious metals is in Australia today clearly exercised as an incident of sovereignty.

One should bear in mind in reading Australian law that the term "Crown" is here but a synonym for "Government," and that the phrases "Crown Lands," "Crown Land Acts" and "Crown Grants" mean exactly the same in every way as the American expressions "Public Lands," "Public Land Laws" and "Government Patents." The disposal of the Crown or public lands and the revenues derived therefrom are absolutely under the control of the elective legislature or parliament of the country or colony in question. The ownership of all the "Crown Lands" in Australia is as much a personal prerogative of the English king as the ownership of the minerals, and it is quite as logical to deny the sovereign right of the United States to its public lands on the basis that such lands are in the English colonies called "Crown Lands" as it is to deny its sovereign right to the precious metals.

Furthermore, the doctrine has long

been accepted by the American courts that the English common law is, in the absence of any specific legislative modification, binding in the United States. On this principle as well as on the one that the United States singly and collectively is and are the successors in interest to the rights and privileges of the British government, the precious metals are in the United States the property of the Government. This means that in all States where the Federal Government has never owned the land, and there are 19 such States, the ownership of the precious metals lies with the State Government (in several of the older States this has long been recognized), and that in States where the ownership of the land has been vested in the Federal Government the ownership of the precious metals in like manner lies with the nation, and that as against the Government no person has a right to gold and silver in any lands in the United States unless this right has been specifically granted to him in the deed of conveyance.

The enforcement of this right in the United States, if ever undertaken, will doubtless be carried out in much the same way as in Australia, where it is utilized, not as a means of hoarding these minerals and mines for the exclusive use of the government, but as a means of promoting and permitting development. This prerogative enables the Government to insist on the doctrine, as regards all precious metals, that if the owner of the freehold will not work them or permit someone else to do so, the Government will exercise its right and promote the welfare of the country by permitting the development of these deposits, always, however, providing for the indemnification of the freeholders for loss or damage caused by mining operations.

AUSTRALIAN POLICY TO ENCOURAGE MINING

The assertion of the right of the Government to all precious metals, made on the discovery of gold in Victoria, was not intended to open freehold land to reckless prospecting. Although the Government owned the minerals, it did not have a right to the land, and it could not, without specific legislation, authorize anyone to enter upon such freehold property without the consent of the owner. The first regulations issued in New South Wales on May 23, and in Victoria on Aug. 18, 1851, clearly define the attitude of the Government on this point in the following words:

"With reference to lands alienated in fee simple, the commissioners will not be authorized for the present to issue licenses under these regulations to any persons but the proprietors or persons authorized by them in writing."

The intention of the Crown to insist on license fees for all gold digging on private property suggested in these early

regulations was not carried out in Victoria as it was in New South Wales, and the practice speedily grew of tacitly allowing the freeholder to make such arrangements as he chose and to protect those arrangements, the Government making no claim to any of the profits.

In Ballarat and other of the goldfields much difficulty was caused by private holdings. The law previous to the discovery of gold gave to the holders of pastoral leases a preëemptive right to select 640 acres anywhere on their leases, and these lessees at once proceeded to select and purchase auriferous ground. Although this practice was prohibited after a short time, it was not till extensive areas of mineral lands had passed into private hands. Large tracts were thus locked up and unworked as mines, and often not even prospected, and while miners could generally obtain licenses from the freeholders to enter, it was only on payment of unduly heavy compensation. Attempts were made at once to have these lands opened up to development, but, although one or more bills were introduced at almost every session of Parliament from its first meeting under responsible government in 1856-7, no Mining on Private Property Act was passed until 1884.

Under the present law either leases or claims can be acquired on private lands on payment of compensation for damages, the compensation to be fixed by agreement or, failing agreement, to be assessed by the local mines-department office, the warden. For gold leases a rental of 6d. per acre per year is collected by the Government in the case of lands alienated prior to 1884, and 2s. 6d. for lands alienated since that date. In leases for minerals other than gold which can be granted only to lands alienated since the reservation of all minerals on March 1, 1892, the rental is not to exceed 1d. per acre. The reason for the difference in the rental on gold leases as to lands alienated prior to 1884 and subsequent to that date is apparently to be found in the lesser amount of compensation which can be assessed in the latter case.

AN ANOMALY IN ROYALTIES

In private arrangements between miner and owner the compensation for surface damages frequently takes the form of royalty, and there has thus developed in the administration of this law the anomaly of the miner paying an acreage rental to the Government which has no surface rights, and a royalty to the freeholder who has no claim to the minerals on which the royalty is paid. This unique royalty system in connection with mining on private property was severely criticized by many witnesses before the last Victorian Royal Commission on Gold Mining. In New South Wales the logical course has been followed in the new

Mines Act of 1906 of abolishing the old clause which permitted the freeholder to collect royalty on that which it did not own, and making such an agreement illegal. The New South Wales act now provides for a rental to the surface owner and a royalty to the Government.

Areas of private lands on the gold-fields proved such a hindrance to development that a demand was at once made that tracts supposed to be mineral bearing should not be alienated. This demand found expression under similar conditions in the United States, but produced much less tangible and effective results. In Victoria the first lands act (24 Victoria No. 117, 1860) passed after the discovery of gold, contained the prohibitive statement: "No lands known to be auriferous or mineral shall be alienated." In the lands act passed two years later this was changed to the statement: "The Governor in Council may withdraw from sale as being auriferous or mineral . . . any lands about to be selected, rented, or purchased," and in 1865 this was changed to the rather more effective provision, under efficient administration: "The Governor in Council, if he shall think fit, may withhold or may withdraw from sale, selection, or leasing any land or allotment." Under these provisions the practice began of referring all land papers to the officers administering the mines side of the land affairs for indorsement as to whether or not the lands might be needed for mining purposes, the Government refusing to part with lands which the mines officers thought it advisable to hold. This plan has proved successful in Victoria and other Australian states to a degree astonishing to one familiar with the administration of the American land office.

Recognizing that, however efficient a corps might be, it could not be omniscient, the Lands Act of 1869, while continuing these provisions, added another providing for the resumption by the Government for mining purposes of any lands, other than auriferous, on payment of value. This appears to have been designed not only as a means of remedying the injurious effect of any alienation of mineral land which might have inadvertently occurred since the passage of the first land law, but also, and this was the main object, to remedy that which had been done under regulations passed before such a need was appreciated.

As the practical difficulty of entering private property for the purpose of searching or mining for precious metals became more evident, the Government took the step, in 1872, of reserving in grants of lands sold at the mining town of Buninyong the right to mine at a depth of not less than 180 ft., and to occupy the surface on payment of damages. On May 8, 1873, a new form of grant was approved which contained the reservation of the right to search and

mine for gold on payment of damages. Such a reservation has in one form or another continued to this day. The provisions of this new grant form were included in the next lands act, which was approved Dec. 12, 1884. During this period areas covered by leases and licenses for pastoral purposes were considered as essentially private lands, and in order to obviate the delays and difficulties which were encountered under the provisions of the Mining on Private Property Acts, it was provided in the 1890 Lands Act that there should be "inserted in every lease of a pastoral allotment, and in every lease of a grazing area, the covenant that the lands are demised . . . under the condition that the holder of a miner's right or of a mining lease shall have the right to enter on such areas and search and mine for gold without payment of compensation for surface or other damages."

MINING LANDS SHOULD NOT BE SOLD

The question of the advisability of selling lands containing minerals was gone into at length by the last Royal Commission on Gold Mining, and they reported in 1891 as follows: "The great bulk of the evidence throughout the whole course of the inquiry bears out the opinion that no greater mistake can be made by the State than that of alienating mining lands. There is no necessity whatever for disposing of such areas in fee simple. No use to which the land can be applied requires that it should be sold. On the other hand, experience proves that when land is once alienated it is extremely difficult to enter in and mine upon it. The Mining on Private Property Law does not adequately meet the case. Its operation is cumbersome, expensive and slow; and the only safe course, as it seems to us, is to reserve all mining areas from sale."

As a means to this end, the commission recommended that the "geological survey of the colony be completed with all possible expedition, and the survey of the lands yet remaining in the hands of the Crown should be proceeded with first." One of the immediate results of the recommendations of this commission was the redoubling of the administrative efforts to prevent the alienation of lands supposed to contain minerals, and the incorporation in the Lands Act of 1891 and the Mines Act of the same year, of a provision that grants of land would, after March 1, 1892, convey only surface values, that all minerals would be reserved to the government.

DISCRETIONARY POWERS OF VICTORIAN OFFICERS

The practice is still continued of referring all land applications to the mines department for indorsement of recommendations.

One of the most impressive features

of the Victorian mining enactments is the large number of things left to the good judgment of the officers administering them. The mining law as originally enacted rested largely on executive discretion, and in the half century during which it has been in operation there has been no essential change in this respect, although mines acts and mines amendment acts have been numerous. Among mining men there is a general feeling of satisfaction with the administration of the department. In one or two instances there is a suggestion of a weak minister of mines yielding to the importunities of workmen during a strike, and there is some complaint that certain mineral lands were alienated when they should not have been, but the net result is wonderfully good. One American, who had been engaged in mining in Australia for several years, complained that he had not found "palm oil" effective in Australia, a result which his experience in America had not led him to expect. The Australian mining man's comment on this statement was emphatic: "'Palm salve' will not work here. There may be occasionally an official who is slightly off color, but he and the persons treating with him will always take a cropper in short order."

Perhaps it might be suggested from this that a law which leaves things to executive discretion appeals strongly and potently to the Anglo-Saxon's honor. Such a law clearly says, "It's up to you," and may have points of efficiency, from a human standpoint, which a law lacks that is framed on the supposition that, as no man sufficiently honest can be found to administer it, nothing can be left to executive discretion.

Provisions were first made for leasing auriferous lands in October, 1852. The rather excessive demands of the Government of that date, which had been exemplified in the attempt to increase the license fee, were again shown here in the offer of annual leases at a rental of £720 per acre. This rate was determined in this way: At this time one man's ground was fixed at the absurdly small area of 12x12 ft., and 20 men might take up half an acre. Each of these men paid 30s. per month; therefore it was argued that the correct lease fee for an acre was 2 times 12 times 20 times 30s. It is needless to say that no leases were applied for under such conditions. Subsequent regulations provided for leases at a royalty of 5 per cent., but none were applied for until after the passage of the Act of 1857 and the proclamation of regulations fixing the rent at £5 per acre per year. Mining leases were at once applied for from all over the goldfields, and the first of these was issued in 1859.

As to minerals other than gold, the first definite legislative authorization of leases is found in the Lands Act of 1860. The first lease issued under the provisions of this act was for antimony, and bears the

date Nov. 13, 1861. A coal lease was issued in 1862, but was antedated May 22, 1861. Several coal leases were issued at this time in widely separated parts of the country.

The mines department has not published since 1891 any data regarding the total areas covered by leases in force at any given time. Up to Dec. 31, 1891, the last date on which the mines department published these data; there had been issued 17,639 gold leases covering 345,473 acres. In 1906 mining leases for 84,546 acres were issued.

GOVERNMENT LEASEHOLD BETTER THAN FREEHOLD

Government leasehold, as a method of dealing with minerals, has thus been tried in Victoria for over 50 years, and mining men are a unit in indorsing it as a better method of promoting mining development than freehold. This assertion is based on the statements of the following men: Ager Wynne, member of the House of Representatives, a mining lawyer and capitalist of Melbourne and member of the Victorian Chamber of Mines; F. G. Hughes, vice-president of the Chamber of Mines, a man intimately associated with many large mining concerns; A. H. Merrin, former president of the Chamber of Mines, consulting mining engineer, and now chief mining inspector of Victoria;

Henry Gore, a mining engineer and a member of the Victorian Chamber of Mines; and on the statements of the following leaders of the different political factions of Australia: Hon. Alfred Deakin, present prime minister of the Commonwealth; Hon. Joseph Cooke, leader of the Opposition (conservatives and anti-labor) in the House of Representatives; Hon. John Christian Watson, Labor leader of the House of Representatives and premier of the Commonwealth from April to August 1904; Hon. William Hill Irvine, former premier of Victoria, and leader of a section in the House of Representatives, which, while anti-labor, does not entirely agree with the Opposition. Many of these gentlemen are intimately connected with mining, and all are closely in touch with the sentiment of the country in this matter, and they affirm that the mining interests of Australia unanimously indorse leasehold as a better method of promoting mining development than freehold. Clearly, the matter of government leasehold is not a party question; indeed, in Australia it is apparently not a "question" at all.

The Royal Commission on Gold Mining, appointed in 1899 to inquire, among other things, into the best methods of promoting mining developments in Victoria, examined about 500 witnesses and found no man who recommended free-

hold. This commission, including prominent mining men, capitalists and members of Parliament, instead of recommending freehold as a means to this end, state: "The great bulk of evidence throughout the whole course of the inquiry bears out the opinion that no greater mistake can be made by the State than that of alienating mining lands. There is no necessity whatever for disposing of such areas in fee simple. No use to which the land can be applied requires that it should be sold."

This recommendation is made in a country which has entirely repudiated the doctrine of the nationalization of the land in an agricultural sense, and by some of the very men who have been prominent in this repudiation. The attempt has been made in several of the Australian states to initiate a system of not alienating agricultural lands. In some states this has assumed the form of a perpetual lease, but in all the states, including New Zealand, this doctrine, after trial, has been abandoned. The policy of the nonalienation of mineral lands, the practice of reserving to the Government all minerals and of working minerals on State leasehold, which is now binding on all Australian states and is heartily indorsed, is thus not a socialistic dogma or abstract doctrine of political economy, but an institution founded on actual trial.

Mining in German Southwest Africa

SPECIAL CORRESPONDENCE

A fever of prospecting and promotion has spread over the Luderitz Bay district in German Southwest Africa, resulting in stock operations in Germany which might be criticized. There are now over 80 diamond companies in the district, 25 of which are being made the basis of speculation at the new stock exchange of Luderitz Bay.

PRINCIPAL MINES

The two main enterprises are the Diamant-Pachtgesellschaft, formed in Berlin to work the diamond properties kept in reserve by the Government, and the Deutsche Diamanters-Gesellschaft m. b. H., which works the properties of the Kolonial-Gesellschaft für Südwestafrika.

The former company started its operations in March, 1909, and had produced at the beginning of October 273,701 carats sold at 7,981,312 marks, upon which the state laid a tax of 3,670,000 marks. The expenses represent about 50 per cent. of the diamonds saved, the cost price per carat varying from 2 to 10 marks according to the conditions. The selling price of the carat has progressively increased from 22.42 to 33.69

marks. The monthly production is about 45,000 carats.

The diamonds are found on the shore of Luderitz bay, and it is a question whether they come from a submarine deposit or were brought by the Orange river and carried by the sea from the river mouth to the bay. Against the latter hypothesis it is pointed out that the stones do not show any sign of so long a transport. The discovery of two diamonds in andesite in the valley of the Molopo river (British Bechuanaland) aroused interest.

Outside the diamond-bearing sands of Luderitz bay, the mining activity is mostly concentrated in the Otavi copper mines. During the last year the output of the Otavi Minen und Eisenbahn Gesellschaft was 44,200 tons as against 25,700 tons in the previous year. The main mine of Tsumeb is worked to a depth of 70 m. with 230,000 tons of ore in sight. Between April and September, 1909, the company shipped 9700 tons of ore, 1290 tons of lead and 870 tons of matte; besides, 2000 tons of ore and 800 tons of matte are ready to be shipped. It is expected that the daily output will soon reach 300 tons.

In the newly opened mines of Osis and Gushab, rich ores are found yielding 27 to 29 per cent copper. The Otavi Exploration Company, Ltd., will prospect some discoveries made in the dolomitic limestones of the Otavi mountains. Expeditions were sent out by the Anglo-German Copper Company, Ltd., the Hanseatische Land und Minen Exploration Company, the Kaoko Land und Minen Gesellschaft and the Kharas Exploration Company to look for copper deposits as well as for diamonds and coal.

Mining in Manchuria

The State department has received official assurance that the agreement between China and Japan, relating to mining in Manchuria, affects only the operations of Chinese and Japanese in the district along the South Manchurian and the Antung-Mukden railroads. If minerals are found within the designated territories by Americans or others, no objection will be made to their working mines under concessions granted by China.

Report of Mysore Operations in Kolar Goldfield

During 1909 the battery of 210 stamps of the Mysore Gold Mining Company, Kolar district, India, crushed 234,500 long tons of quartz from which gold to the value of £894,834 was recovered, equal to an extraction of 76.3s. per long ton or 67.9s. (\$16.52) per short ton. The most of the gold is won by amalgamation, 83.4 per cent of the total value of the ore being recovered by this process. The ore averaged last year 19dwt., 8 grains of fine gold per ton. The balance of the recovery is obtained by cyanide. The report does not make it clear what amount of gold is won from current tailings and what from stored tailings, of which there are still about 125,000 tons to be treated. The actual tonnage dealt with by the cyanide department was 190,388 tons of tailings. The cyanide and zinc consumption per long ton of tailings was 0.57 and 0.07 lb. respectively.

As regards information about expenditure, the report of the directors, as in former years, is sadly deficient. Except for one short paragraph, which refers to a saving to be effected in the cost of carriage owing to the construction of a new railway siding, no allusion to working costs is made either by the directors or the manager. It is true that a statement of revenue and expenditure is given with a fair amount of detail, but as the figures are not calculated on a tonnage basis, a comparison with previous years is not

possible without a good deal of laborious computation. Two tables are given from which the grand totals from the commencement in 1884 to date may be computed, without great loss of time, and these show the following results:

TOTALS AT MYSORE.

Total tons crushed, 1884-1909.....	2,452,959
Total tons tailings treated.....	2,105,245
Amount realized.....	£11,680,522
Total dividends paid.....	£ 5,935,094
Yield per ton of 2240 lb.....	91.5 s.
Yield per ton of 2000 lb.....	81.4 s.
Dividends per ton of 2240 lb.....	48.4 s.
Dividends per ton of 2000 lb.....	43.1 s.

The average costs, therefore, including the unknown amount that has been put back as capital for extensions, have been about 43s. per long ton or 38s. (\$9.24) per short ton. During the year under review (1909) the costs according to the revenue and expenditure account, which includes London expenditure, amounted to 33.2s. per long ton milled, or, including depreciation and amounts written off machinery and plant, buildings, etc., 36.6s. per ton.

LARGE PROFITS MADE

These costs will appear high when compared with those of the Rand where, calculated on a similar basis, they were 20s. (\$4.86) per ton in 1909, but, as pointed out by Doctor Hatch in his work on the Kolar Goldfield, published as a memoir of the Geological Survey of India 10 years ago, there are special rea-

sons why costs are high. Among these are the occurrence of the ore in pay shoots, necessitating a heavy expenditure in development, the stoping only of high-grade ore, and the heaviness or instability of the ground calling for much timber.

While there is some doubt whether the mine is being worked as economically as it might be, there is no question about the profitable nature of the operations. After putting a large sum to reserve and writing off liberally for depreciation, the company paid last year dividends aggregating 115 per cent. on the nominal capital.

The development of the mine continues to be of a satisfactory character. In the Ribblesdale section the lode is exposed at a depth of over 4000 ft., maintaining its width and richness. In Tennant's section the depth is not far short of 3000 ft. At the deepest level the lode is 6 ft. wide and averages over an ounce of gold to the ton. The southern section, McTaggart's, has been less productive during the year than formerly, but it is hoped that the bottom levels will soon pass out of the poor zone that they are now in. The reserves of ore are stated to be over one million tons, which is a four-year's supply for the mill at the present rate of crushing, but the information loses a good deal of its importance owing to the absence of a statement as to the value of the ore.

Premier Diamond Production in the Transvaal

In their annual report, the directors of the Premier (Transvaal) Diamond Mining Company announce that the operations during the year ended Oct. 31, 1909, showed a profit of £438,811, as against £789,963 in 1908 and £875,729 in 1907. Profit in suspense, being diamonds on hand at the end of the year, figured at £355,297.

PRODUCTION AND QUALITY

The production for the year amounted to 1,872,136 carats, a decrease of 206,688 carats on that of the preceding year. It might be concluded from the difference in the average per carat for the last two years that there has been a further fall in the quality of the diamonds produced. The directors, however, state that this is not so, and give the following reasons: Last year's average of 14s. 9d. was arrived at by including over £500,000 worth of diamonds sold to the diamond syndicate at the full preliminary contract prices. As, however, there was a seri-

ous loss sustained on realization of these goods by the syndicate which could not be shown in last year's accounts, it will at once be seen that the average stated was not ultimately realized.

REVALUATION OF LOW GRADE STOCK REDUCES ASSETS

Further, the stock of about £600,000 brought forward at the end of October, 1908, was realized for the greater part during 1908-9 and, despite all precautions in estimating its value, this has shown a loss on revaluation, chiefly in the lower qualities which it necessarily contained. These lowest qualities have not been reduced in quantity during the year under review, but have to some extent been increased, and the board has written the whole of the stock of that class down to a low level, and has made this year's average carry the whole of the depreciation.

The complete shipments included in the stock on hand at Oct. 31, 1909, have

shown marked appreciations against stock prices, the benefit of which will only be reflected in next year's average. The directors claim that when allowance is made for the points above enumerated, there has been no difference in the average quality between the last two years.

REVENUE

The realized profits up to Oct. 31 have enabled the company to meet all capital expenditure, liquidate the balance of loss in connection with the diamond syndicate and provide for the two preference dividends for the year. Since its inception, the revenue of the company has amounted to £4,441,918. Against this the company has spent £1,516,696 in equipment, the Government has been paid £1,085,915, dividends amounting to £980,000 have been distributed to stockholders, and trading and emergency funds of £300,000 and £100,000 respectively have been created.

Two Important Iron Ore Deposits of Australia

Iron Island Deposit Consists of Hematite and Magnetite. Koolan Island Contains Larger Bodies in Unexplored Country. Both Low in Phosphorus

BY J. BOWIE WILSON*

Australia is richly endowed with mineral wealth and has greatly benefited by the exploitation of its gold, silver, copper, lead and coal mines. Iron ore has been known for many years, yet this reserve of mineral wealth remains practically untouched. It must surely, in the near future, attract attention and be the means of creating employment for many men and make available new channels for the profitable investment of capital.

Of the Australian States, New South Wales alone possesses iron smelting works. They are at Lithgow, about 100 miles from Sydney, upon the western railway and on the western side of the coastal range of mountains. The supply of ore is from a deposit in the neighborhood. This plant is still in its infancy, and it remains to be seen if it will become the nucleus of a big iron and steel producing industry, or if it will be killed by the competition of already well established works in other parts of the world.

Attention has lately been turned to some of the big deposits of iron ore that occur upon the seaboard of Australia, and on at least two of these leases have been taken up with the idea of developing an exporting trade in iron ore. Although one of these deposits occurs upon the northeastern coast of Australia and the other upon the northwestern coast, both are largely in the same hands; they both occur on small islands close to the mainland and in general position, although separated by the width of the continent, have somewhat similar features. They are known as Iron island and Koolan island.

IRON ISLAND

This island is one of the smallest of the Duke group, which is about midway between Rockhampton and Mackay, on the coast of Queensland, and about 10 miles from the mainland, but outside the Great Barrier key which protects the northern half of Queensland's coast line. The accompanying maps, showing its position and geological structure, are taken from the report of Lionel C. Ball, assistant Government geologist, issued in 1904 as publication No. 194. As will be seen, the island is of small extent, having a maximum length of 20 chains by a width of 8 chains, with the highest point 120 ft. above high-water mark. Mr. Ball describes the geology as follows: "The rock on the western side of the island is a

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greenish, highly altered trachyte in which there has been a great development of east and west quartz veins, probably formed before the iron was introduced into the adjacent country. On the south side of the island are three outcrops of pure white statuary marble from 10 to 20 ft. across and a chain in length. The ore consists in greater part of cryptocrystalline magnetite, with massive hematite, having a visible trace of impurity."

ANALYSIS OF ORE

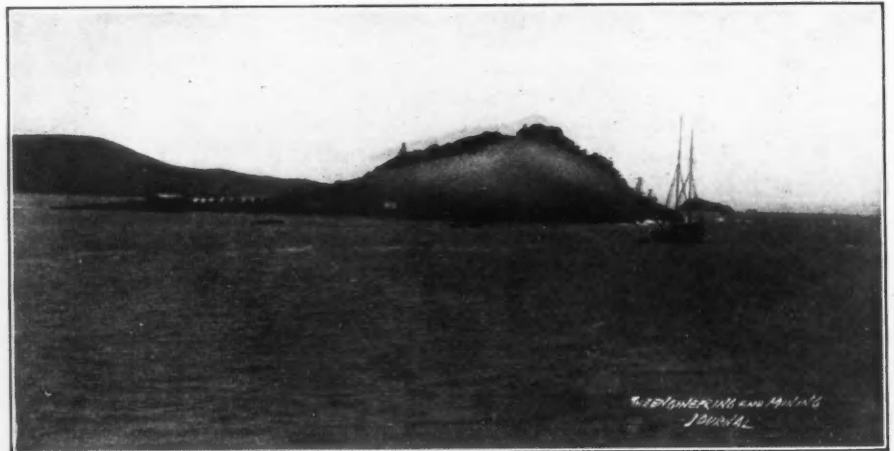
A rough surface sample taken from over the whole of the iron-ore area was analyzed at Mount Morgan, as follows:

Water, 0.13 per cent.; silica, 2.51 per cent.; aluminum, 2.95 per cent.; iron,

was made that upon the payment of a fixed royalty per ton and the construction of a jetty and bins from which steamers could load, the Mount Morgan Company could mine 125,000 tons of ironstone. Under this agreement the Mount Morgan Company has already removed 90,000 tons of ironstone, the stone being shipped to Rockhampton and then by rail to Mount Morgan.

MOUNT MORGAN TO ABANDON IRON ISLAND WHEN MANY PEAKS MINE IS IN OPERATION

Upon the completion of the Boyne Valley Railway, which will connect Mount Morgan with the Many Peaks pyrite mine, it is expected that the Mount Morgan



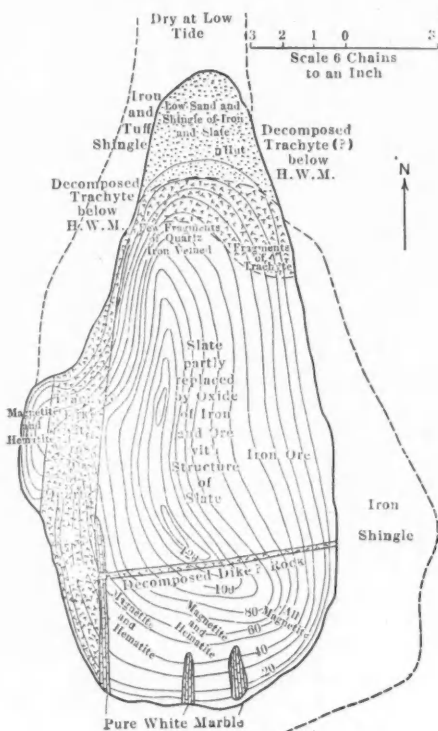
IRON ISLAND WHICH NOW FURNISHES THE MOUNT MORGAN COMPANY ITS IRON FLUX FOR SMELTING OPERATIONS

64.72 per cent.; equivalent magnetite, 89.73 per cent.; equivalent hematite, 91.34 per cent.; manganese, none; lime, 2.85 per cent.; magnesia, 1.07 per cent.; phosphorus, 0.035 per cent.; titanium, none.

This island was taken up as a mineral lease several years ago by Percy Kean, a Charters Towers prospector, who believed that a deposit of high-grade iron ore situated so favorably for transport must eventually be of value. He formed a small company (The Marble Island Iron and Limestone Company, Ltd.), consisting largely of Charters Towers speculators, to finance the property and do a little prospecting work. In 1907 the Mount Morgan Gold Mining Company was looking for a supply of ironstone to flux the silicious copper ores, and approached the owners of Iron island. After some negotiations an arrangement

Company will stop taking the barren ironstone flux from Iron island, when the property will revert completely to the Marble Island Company with all the improvements put in by the Mount Morgan Company. The Marble Island Company will then have to look for other customers for its ore, but being in the fortunate position of having a quarry opened, equipped with bins, a loading jetty at which the coastal steamers can load, and being on the main route of shipping along the northeastern coast of Australia, the property must remain a valuable one. Although the Mount Morgan Company will have removed over 100,000 tons there will still remain a large quantity of ore. Mr. Ball roughly estimated that there would be over a million tons available above water level.

This contract with the Mount Morgan Company having placed the Marble



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GEOLOGICAL SKETCH OF IRON ISLAND

Island company in a satisfactory position, Mr. Kean was encouraged to locate similar ironstone properties. Having heard, when prospecting in Western Australia, of an island upon the north-west coast which seemed somewhat similar to Iron island, Mr. Kean formed, in 1907, the Australian Prospecting Asso-



The Engineering & Mining Journal

PORTION OF QUEENSLAND, SHOWING IRON ISLAND AND MOUNT MORGAN

ciation, Ltd., to investigate the district in West Australia. After a trip up the coast from Derby, Mr. Kean found the deposit and pegged five leases.

KOOLAN ISLAND

This discovery was considered of sufficient importance to induce the West Australian government to send W. D. Campbell, geologist, to Koolan island in June, 1908. The accompanying sketch from his report shows the position of the deposit and also the leases pegged thereon. The island is about eight miles long by one mile wide, and parallel to its greatest length is a series of ridges. Mr. Campbell reports that these ridges consist of sandstones, quartzites and schists, having a strike of S. 62 deg. E and dipping 50 deg. to the south. The iron ore is interbedded in these strata, the outcrops being prominent on the south side of the island. The ore is anhydrous, retains a black metallic luster

About three-quarters of a mile north of lease No. 131 there is a small steep-sided bay near which iron ore outcrops. The outcrop is about 40 ft. wide, and toward the east it splits into two beds which follow a nearly parallel course, about 20 chains apart; the northern one continues for about a mile, but the southern one a further distance. Both dip to the south and range from five to 25 ft. in width.

It appears that the southern lode will average 20 ft. in width, and as its outcrop has been traced three miles from an average height of 250 ft. above sea level, and dips at a flat angle an enormous quantity of ore should be available above sea level. Outcropping as it does along a steep ridge, it should be cheaply mined by quarrying, or by tunnels into the lode and then "milling" the ore down chutes.

Analyses of a typical sample gave: Iron, 66.48 per cent.; silica, 4.16 per



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KOOLAN ISLAND, WESTERN AUSTRALIA

but is not uniformly magnetic. At the western end of lease No. 130 the iron ore forms the south slope of the ridge, from its summit (350 ft.) to its base at water level. This lode outcrops more or less continuously through the 1½ miles easterly between this point and lease 132, where the general character of the ore is similar.

THE VARIOUS OUTCROPS

In the three western leases the lode appears to vary from four to 50 ft. in width, while in places another smaller lode appears about 50 ft. distant on the northern side. In the orebody there are occasional bars and patches of vissicular iron ore, while sheets of this material appear to accompany the ore in other places. Toward the foot of the cliff in the western leases there are gray micaceous slates and on the opposite side of the shallow bay there are silicious and ocherous beds.

cent.; sulphur, 0.072 per cent.; phosphorus, 0.064 per cent.; moisture, 0.08 per cent.; combined water, 0.12 per cent.

ECONOMIC CONDITIONS

Koolan island has ideal shipping facilities, as the outcrop runs parallel to Yampi passage, an inlet off Yampi sound, with sufficient depth of water to carry steamers. The only difficulty to be incurred will be the big rise and fall of the tides. Yampi sound is about 100 miles north of Derby, a shipping port situated at the head of King sound, on the north-west coast of Australia, and is on the direct route of boats going to Singapore or to the North Australian cattle ports. As a considerable trade in cattle is developing along this coast, cheap freight rates should be available, as ballast is desired for these boats and also by tramps from Singapore.

The island is uninhabited. The mainland opposite, and from which the island

is only separated by a narrow channel, is uninhabited, containing only a few wandering aborigines. The district is practically unexplored. The blacks not being trustworthy, and water scarce, it is

not a good prospecting country. In opening up the deposit it will be necessary to make Derby the base and communicate with the island by means of small coasting boats, as the large steam-

ers would only call if ample freights were offered. Derby is a settled town, where supplies may be obtained. It has a good jetty and water supply and about 70 steamers call there annually.

The Blackwater Mines at Waiuta, New Zealand

BY SIDNEY FRY *

The Blackwater mines are situated at Waiuta, about 12 miles south of Reef-ton, the most important mining camp in South island, New Zealand. The ore-body, known as the "Birthday Reef," is an auriferous vein lying in the same great gold-bearing belt as the Reef-ton deposits which it resembles in many ways. The vein, which varies from a few inches to 12 ft. in thickness, is of the "bedded" type and is situated between a grey-wacke 50 to 100 ft. thick, which forms the hanging wall, and argillites which form the footwall. The ore is white quartz seamed with fine crenulated lines of dark-colored mineral consisting of mispickel, pyrite and stibnite, and containing free gold. Of the sulphides contained by the ore, the arsenopyrite forms by far the major portion. The stibnite occurs in extremely small quantity.

DISCOVERY AND DEVELOPMENT

The deposit was discovered early in 1906 by a party of prospectors, and was first located by the method known as "spearing." The prospecting spear most generally used in New Zealand, is made of a round rod of wrought iron $\frac{5}{8}$ in. in diameter, and having a piece of steel welded into one end which is pointed for driving into the ground. The other end of the rod has a length of round iron $1\frac{1}{2}$ in. in diameter and about 9 in. long, welded to it, and the end of this is faced with steel and worked into a pestle head so that it may be used for crushing quartz in a dolly-pot. In prospecting the procedure is to follow along the backs of the ridges or along the beds of streams, in a direction at right angles to the strike of the bedding planes of the country rock, and where no bedrock is visible, to pierce the layers of surface soil and sound the rock with the end of the spear. This is done at intervals of a few feet, and to a practised ear and hand the sharp clink and hard "feel" of quartz are almost unmistakable.

Shortly after the discovery of the vein the prospectors sold out to a local investor for \$10,000, and he, after opening it out to some extent, sold to the Consolidated Goldfields Company for \$150,-

000. This company proceeded to develop the ground vigorously, and at the beginning of 1909 commenced to crush ore. A main shaft was sunk to a depth of 500 ft. and three levels driven on the vein, of which No. 2, called the "Joker" level, comes out at the surface and forms the main road for the ore going to the battery. The ore cars carry about a ton, and are run in trains of six or eight, the full set being run out by gravity and the empties drawn in by a horse.

At the end of the tramway the ore is dumped into a bin, and from this is filled into cars on a self-acting incline or "jig," by which it is lowered into the tipping shed on the battery bin. The "jig" cars,

Andrew Watson, the mill superintendent, and has resulted in a considerably increased output, although as yet only one tube mill has been installed. The method is eminently suitable in this case as the ore is often much crushed in the mine and as taken out contains a large proportion of fines. The tube mill is a 16x4-ft. "Burt" mill, with feed and delivery through hollow trunnions. Brown's steel liners are used. The pulp is ground to pass a 25-mesh screen and is then passed over amalgamated copper plates.

The ore is fed to the stamps by automatic suspended "Nelson" feeders which are actuated by tappet rods. There are six 5-stamp batteries, three Prices and



BLACKWATER MINES AT WAIUTA, NEW ZEALAND

which hold two tons, dump their loads on a grizzly from which the oversize is fed by a shaking trough into a Marsden rock breaker. The undersize is passed along two side chutes, having bottoms of punched plate, with holes $\frac{1}{2}$ in. diameter.

CRUSHING AND AMALGAMATION

The undersize from these chutes falls into a bin, from which it is fed directly to the tube mill without passing through the batteries. The stamps are thus relieved of much unnecessary work. This divergence from the usual tube-milling practice is the outcome of the ideas of

three Hendys. The stamps weigh 850 lb., have an 8-in. drop and make 100 drops per minute. The pulp passes through 25-mesh, woven steel-wire screens, thence through a launder to a distributing box, which delivers it to five 12-ft. amalgamated copper plates set at a slope of $1\frac{3}{8}$ in. to the foot. The plates are some distance from the front of the mortars. The advantages claimed for this arrangement are (1) absence of vibration and (2) ease of accessibility. Seven plates are laid down, six for constant use and one reserve plate. The latter is used while one of the other plates is being

*Mining engineer, Westport, N. Z.

dressed in order that the distribution of pulp may be kept uniform.

CYANIDING

From the plates the pulp passes through amalgam traps and thence to spitzkasten, the sands from which go on to the cyanide leaching vats. The plant for the treatment of the sands consists of seven circular steel tanks 20 ft. in diameter and seven feet deep, together with a dissolving tank and three sumps; four 8-compartment zinc extractors, with compartments 19x26x17 in.; and three 3-in. centrifugal pumps for handling the cyanide solution which is used at 0.3 per cent. strength. The extraction from the sands is so high that it is not considered necessary to grind them finer than 25-mesh.

The plant for the treatment of the slimes from the spitzkasten, although constructed, has not as yet been placed in

operation. It is intended that the de-watered slimes be treated with a 0.3 per cent. cyanide solution in Brown agitation tanks. There are four of these tanks, 10 ft. in diameter and 40 ft. high, built upon substantial foundations cut out of the solid rock. After agitation the slimes will be discharged into three filter tanks where a basket filter will remove the gold solution. The filter when fully charged with slime cake will be washed, and will then discharge its worthless residue into a waste launder which will discharge them into the river.

A Price 6-in. slime pump, with double plungers and a 15-in. stroke, has been installed for raising the slimes into the Brown agitation tanks. For creating the suction for the filter a Burt 6-in. vacuum pump with a 12-in. stroke will be used. An 8-in. single stage, double cylinder compressor of the vertical type will supply compressed air.

GENERAL DATA

Power for the mill is provided by a high-pressure Pelton wheel with a double nozzle 3½ and 2½ in. in diameter and operating under a head of 120 ft., and by a low-pressure Pelton wheel operated by a 6-in. nozzle under a 19-ft. head. The stamps and tube mill are driven by the high-pressure wheel through the medium of a rope drive. The mill is lighted by electricity supplied by a small Westinghouse dynamo yielding 5¼ kw. at 100 volts.

The average cost of mining and milling the ore during the first four months of 1909 was \$3.83 per ton. During that period 7039 tons were mined and treated, the total value of gold won being \$77,529.60, an average recovery of \$11.01 per ton. In May and June, 1909, 4821 tons of ore were mined and treated, yielding \$54,024.62, or an average recovery of \$11.20 per ton.

Silver-Lead Smelting in Tasmania

BY THEODORE KAPP *

Two fruitless attempts were made to establish the silver-lead smelting industry on the west coast of Tasmania. One smeltery was built at Argenton, about four miles from Zeehan on the Zeehan-Strahan railway, and another one about a mile from Zeehan beside the Zeehan-Dundas railway. Both of those works were in blast only a short time, and had to stop on account of financially unsatisfactory results. In 1898 a third smeltery was erected by the Tasmanian Smelting Company, Ltd. (London), about two miles from Zeehan on the Zeehan-Strahan railway. This company, after a long struggle against great difficulties, finally introduced silver-lead smelting into this field.

LOW GRADE REFRACTORY ORES

The problem which had to be solved was to treat economically the low-grade refractory ores. It was found to be impossible for smelting works to exist on high-grade lead ores only, as European works, on account of their cheap wages and supplies, were able to reduce smelting charges on that class of ore to such an extent that the difference in freight which could be saved by shipping home the silver-lead bullion instead of the ore itself was not big enough to counterbalance the higher costs of treatment.

The larger bodies of low-grade ores in this field are of such a refractory nature that their treatment offered great difficulties and long remained a financial

failure. The most objectionable component of this ore is zinc, which prevents the metallurgist smelting the ores in the usual manner, i.e., for a silver-lead bullion and a heavy matte containing some lead and silver for retreatment. The sulphur which is left in the ore after roasting is for the most part combined with the zinc, and consequently the matte which results from the blast-furnace smelting contains a high percentage of that metal, making it light and preventing its separation from the slag.

It became a necessity to prevent the absorption of precious metals by this matte, and only since experiments in this direction became a success could these ores be treated without financial losses. The business is carried on in the usual manner of custom smelters. The principal supplies of ore are received from the silver-lead mines around Zeehan, and from the low-grade ore deposits of Rosebury, about 17 miles from Zeehan on the Emu Bay railway.

Government reports, as well as the Tasmanian Smelting Company's books, show that the establishment of smelteries not only reduced the export of ores to a minimum, but also increased the total ore output of the district to more than three times its quantity. The quantity of ore which is still being exported (2400 tons per year) is exceptionally high-grade and pure lead ore, which for special reasons is sold to European smelters.

The smelteries were built originally for

treating low-grade ores, and during the first years only low-grade ores were bought. On account of the above-mentioned reasons the treatment of those low-grade ores proved a failure, and in 1900 a start was made to treat higher grade lead ores. This was continued during 1901, when the average lead contents of the ore purchased was above 45 per cent. As pointed out, the treatment of high-grade lead ores cannot be profitable on this coast, and the smelting company had to fall back on experimenting with ores of lower grade. At the same time, a then newly discovered process—the Huntington-Heberlein process—was brought into use, and with its assistance the difficulties of treating the lower-grade ores were gradually overcome, with the result that 39,863 tons, with an average lead content of only 22.6 per cent were treated during 1905.

ARRANGEMENT OF PLANT

The Tasmanian Smelting Company's original plant, erected for silver-lead smelting, contained 3 main departments; the crushing and sampling plant connected with an assay office, the roasting plant, and the blast-furnace smelting plant; the whole being supplied with motive power by a central station, and connected by a branch line with the government line of railways from Zeehan to Strahan.

The general arrangement of the present works is still the same as originally, although some additions and alterations

*Frankfurt a. M., Germany.

became necessary as an outcome of the various experiments which were carried on during the time the works existed. The parallel siding connecting the smeltery with the main railway line gives it an elevation of 90 ft. above the line. On this siding a Howe weighbridge receives the trucks of ore delivered to the company. The scales are self registering and facilitate weighing to the greatest extent.

AUTOMATIC WEIGHING AND SAMPLING OF ORE

After passing the weighbridge the track forks, one line carrying ores, etc., to the crushing and roasting department, while the other and lower one leads straight to the blast-furnace bins.

The materials passing over the top line are delivered at the sampling mill. The operation of automatic sampling is here applied to the ore after it is crushed into a suitable size. It is first fed into a 9x15-in. Blake crusher, then into two sets of Reliance rolls, and after being lifted it passes through a Bridgman sampler, which cuts out an adequate proportion of the ore stream as a sample. The bulk of the ore after having passed the sampling machine, runs through chutes into trucks which carry it into the respective bins, according to its composition.

These bins are constructed all along the roaster building and have a capacity of about 5000 tons. In addition to the sampling mill, which is able to treat about 100 tons of material per shift of 8 hours, there is a crushing and drying plant of equal capacity. This plant is used mainly for flux and for ores which are delivered in a finely crushed state, both of which contain a considerable amount of moisture. The material which is discharged from the drying plant is carried by a belt conveyor into whatever bins may be chosen for it. All the roaster bins, which are, of course, charged from overhead, have doors on their bottom level, leading to the charge floor of the roasting plant.

Fairbanks scales are fixed at suitable distances to weigh the roasting charges in the most efficient and economical manner. The charges ready for roasting are fed into Huntington-Heberlein roasters, of which 12 are available to perform the process of desulphurization. There is a general flue along the back of the roasters which connects with a roomy dust and condensing chamber, and then with a stack 125 ft. 10 in. high, and 8 ft. inside diameter. This height insures a good draft and carries off the noxious fumes above the summits of the surrounding hills.

SMELTING DEPARTMENT

The ores, after leaving this plant, are ready for smelting, and they are delivered on the same level on which oxidized ores and fluxes for the blast furnace are

received direct from the railway trucks. A second system of large bins provides storage room above the blast-furnace charge floor for materials required for the blast-furnace process. The bins are capable of accommodating 4000 tons of ore, 2000 tons of flux, and 1000 tons of coke.

Three lead blast furnaces are available for smelting the mixtures which are made up on two Howe charge scales. The furnaces are of American type, 42x120 in. at the tuyeres. They are 25 ft. high, with a charge column up to 21 ft., and can treat 80 tons of ore per day each. Two are regularly in blast. The fumes from the blast furnaces are discharged above the charge floors by a downtake into the main blast-furnace flue. The latter is large enough to act as a condensing chamber for collecting volatilization products. It is 200 ft. long and is connected with a stack 125 ft. high. The furnace product, silver-lead bullion, is carried on a 2-ft. tramway to the Austral siding for consignment to the shipping port, Strahan. It is exported to England, where it is desilverized and refined.

The slag is tipped over a high dump, the bottom of which is 60 ft. below the blast-furnace tapping floor. It has been tried to granulate the slag and wash it away by running it into a stream of cold water, but as all the water for this purpose had to be artificially lifted, the process did not work economically. Horses are now engaged to pull the big slag cars from the furnaces to the edge of the dump.

POWER PLANT

The power plant supplying the works with motive power consists of 4 large multitubular boilers of 125 h.p. each, working at a pressure of 100 lb. Three of them are in constant use and provide steam for two Reynolds-Corliss engines of 125 h.p. each, a 75-h.p. Reynolds-Corliss engine, and a smaller steam engine, of 50 h.p. The two first-mentioned engines drive two No. 7½ Roots blowers. They supply 87 cu.ft. of air at each revolution and are guaranteed to work up to 5-lb. pressure. They further provide motive power to the various machines of the fitting shop. The 75-h.p. engine drives the sampling mill, and the smaller engine, the crushing and drying plant.

Until Jan. 1, 1906, this company had disbursed £1,181,900. In 1907 an Edwards furnace was installed to experiment with the treatment of ores carrying higher percentages of sulphur. Debentures to the amount of about £30,000 were issued at this time. In spite of this, the company has not been a financial success, as it has not been able to pay a dividend to its shareholders, and the benefit of its enterprise has been reaped solely by the miners and the State of Tasmania in general.

The Proposed Trans-continental Railway in Western Australia

BY CHARLES G. GIBSON*

The preliminary survey for this line begins at Kanowna and passes easterly to Majestic via Bulong and then almost due east across Western Australia to the South Australian border. With reference to the geological features of the country traversed, it may be said that the first 60 miles is a greenstone formation, the next 100 miles is granite and the last 300 miles will extend over a limestone of Tertiary age. The greater part of this belt is covered with extensive recent deposits of sand and loam, and the western portion is fairly well timbered with salmon gum. Immediately along the proposed route, the only rock outcrops of any note are toward Cowarna Rocks, where there are a few low greenstone ridges of small extent and which appear to be almost free from quartz reefs. These outcrops show the country rock to be a fine-grained greenstone, more or less foliated, and similar to that usually found on the Western Australian goldfield.

The greenstones are intersected by occasional granite dikes and masses, one of the most conspicuous of these being Cowarna Rocks. The western boundary of this main auriferous greenstone belt lies about 10 miles west of Cardinia and as shown on the accompanying geological map, runs roughly north and south. East of this line the granite rock is non-auriferous with the exception of a small belt lying immediately west and north of Cardinia, which has a width of about three miles and a length of possibly twenty. The whole country is more or less hilly and broken and in addition to the granite hills there is a series of low greenstone ridges to the west and north. The granite is undoubtedly intrusive and newer than the greenstone. Several small fragmentary areas of the latter can be seen entirely caught up in it.

THE GRANITE COUNTRY

From Cardinia eastward for about 100 miles the country is composed entirely of granite. Vegetation is more or less stunted and the drifting sand hills of the interior are gradually encroaching on the old bed of the Ponton river; it is only a matter of a few years until it will be completely obliterated. From the highest point from which a general view can be obtained the country as far as can be seen with field glasses consists of alternating low ridges and valleys all covered with dense growth of mallee and spinifex.

East of the 167th mile the mallee and spinifex give place to oaks and blue

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NOTE—Abstract of Bull. 37, Western Australia Geological Survey.

bush with scattered salt bush, while the sand planes are replaced by light-colored loam flats. This change marks the approximate junction between the granite country and the Tertiary limestone, which from this point is continuous easterly across the South Australian border and south to the coast. No rock outcrops are visible for a number of miles both east and west of this point. The whole of this limestone area is practically level or at most slightly undulating and is covered with a varying depth of loam beneath which limestone flags can be seen here and there. The elevation of the limestone plateau is 500 to 600 feet.

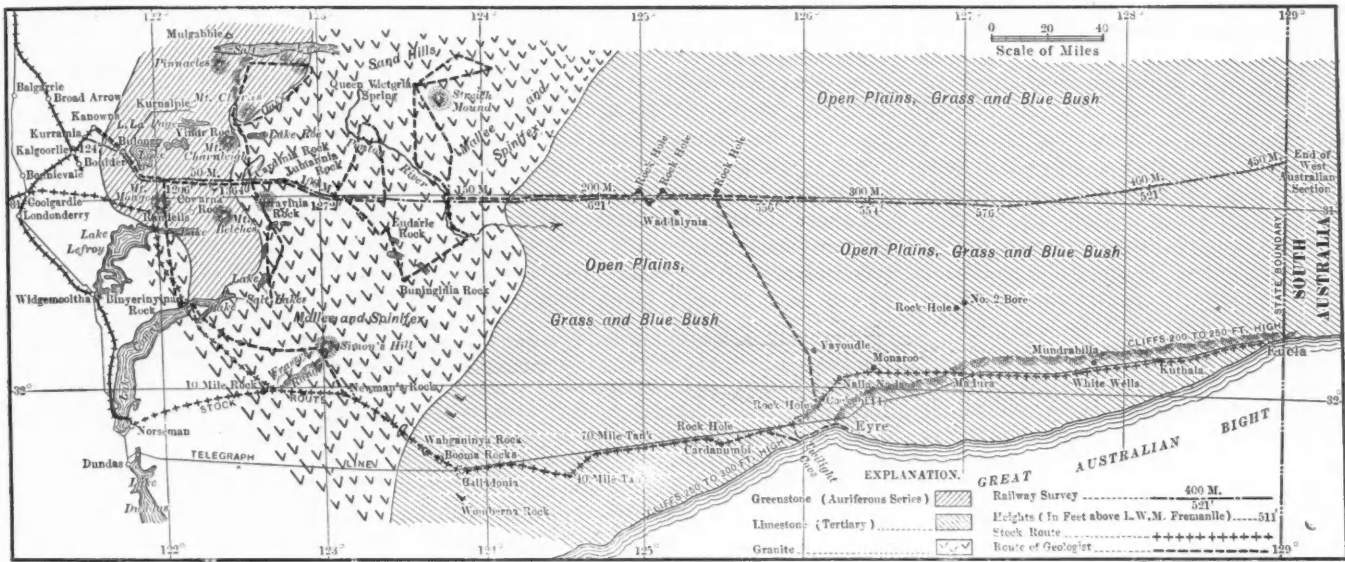
The southern edge of the limestone tableland is marked by a fairly regular line of cliffs from Twilight cove rising vertically out of the sea to a height of 250 to 300 feet.

boring, but the quality judging by previous results, will be none too good, and in addition it will in all probability have to be pumped from a depth of several hundred feet. The strata which form this table land consist of porous limestone, with underlying soft sandstone and clay shales; these beds appear to be horizontal, although a slight prevailing dip to the south has been ascribed to them. On the north the water-bearing beds do not outcrop, but presumably impinge directly on the granite, and receive a large portion of their water along this junction.

On the South Australian side of the border, water bearing beds exist at a depth of 300 to 500 ft. A second main water bearing series appears to exist at a depth of 1000 to 2000 ft. below the upper one, the intervening porous rocks also being more or less saturated

Bessemer & Lake Erie Railroad

The Bessemer & Lake Erie Railroad, the ore road of the Carnegie Steel Company, hauled 6,745,802 gross tons of ore in 1909, against its previous record of 5,843,186 tons, made in 1907. This was for the Edgar Thomson, Carrie and Duquesne blast furnaces. To Dec. 31 last the road had purchased 366,355 steel ties of the I-beam pattern from the Carnegie Steel Company, having now in service steel ties equivalent to 116.5 miles, but not in straight stretches, as the steel ties have been used largely to replace wooden ties as they gave out, no new wooden ties having been laid for several years. It had 16,917 ties left on hand, and 40,000 due on requisition. Besides these, it is about to place orders for 114,000 ties, and



SKETCH MAP OF WESTERN AUSTRALIA ALONG THE ROUTE OF THE PROPOSED TRANSCONTINENTAL RAILWAY

MINERAL POSSIBILITIES

As regards the mineral possibilities of the country lying within a distance of 70 miles from the proposed railway, it can be stated that both the granitic and limestone formations occupying most of the country passed over are nonauriferous. With the exception of the one district at the west it holds out no possibility of mineral wealth of any description. Neither can it be said that the construction of the proposed railway will to any great extent open up mineral deposits already discovered, as they are now accessible from other centers.

WATER SUPPLY

The first 180 miles of the proposed line is practically a waterless stretch. Drilling operations have failed to prove the existence of an underground supply of fresh water. Salt water is obtainable at a shallow depth along any of the systems of salt lakes. Along the section of the line over the limestone table-land water will always be procurable by deep

with water. Over the limestone table land the only surface water procurable is found in small rock holes which are more or less circular in the upper crust of the limestone and hold up to 20,000 gal. of water. The usual capacity, however, is 500 to 1000 gal. After a rain they hold water for a comparatively short time only and are not to be relied upon for supply during summer months.

Production of Fuller's Earth

According to statistics collected for "The Mineral Industry," the production of fuller's earth in the United States in 1909 was 29,561 short tons, valued at \$289,000. Of the total quantity, Florida produced 24,148 tons; the remainder being contributed by Georgia, Arkansas, California and Texas, in the order named. In 1908 the production was 30,517 short tons.

all these will be laid this year, bringing the total track mileage laid in steel ties to about 175 miles at the close of this year. A portion of the new ties will be used for a new second track. The line is now 67 per cent. double track, but by the end of this year will be all double track except for a few miles, embracing three high trestles, which it will require time to fill in. The road will also place orders shortly for additional cars and locomotives. The tonnage of ore to be moved this year has not yet been estimated, but it is expected that a much larger tonnage will be needed than in 1909.

The road was built and is operated almost exclusively for ore and coal traffic, from Erie and Conneaut on Lake Erie to Pittsburg. It has made a record for large trainloads and low ton-mile costs. The earnings of the road in 1909 were \$7,112,828 gross and \$3,299,087 net. The freight carried was 12,590,030 tons, of which 7,555,298 tons were iron ore. The average cost of carrying freight was 0.23c. per ton-mile.

Observations in Coal Mines of Europe

Remarks Dealing with the Improved Conditions Surrounding the Miners,
and Details Concerning the Systems of Flushing and Timbering

B Y F R A N K H A A S *

We must confess that the Europeans know their business, and when all conditions are taken into consideration, there is really no comparison possible between our methods and those found abroad. A mining operation in Europe is looked on more or less as a perpetual proposition, while in this country the life of a plant is the first item for consideration, and in this we find a partial explanation for the apparently extravagant expenditures in plant equipment so noticeable in all parts of Europe.

In Germany we find the best methods of operation. Drift mining is practically unknown in Germany, and shafting extends from 1000 to 2000 ft. through quicksands and loose material presenting the first, if not the most difficult, feature of German coal mining as compared to this alone.

To cover the whole of Europe with a paper appropriate in length is manifestly impossible, so I have chosen one of the principal districts of Germany (Upper Silesia), and will devote my comments to this alone.

The lower seam in Upper Silesia is somewhat of a coking coal and used to some extent as such. As a rule, however, the coals are simply high volatile steam coal and of rather indifferent quality. The coal area of Upper Silesia is grouped together into about twelve large holding companies, of which the kingdom of Prussia is one of the most important.

One of the largest operations in the field is located near the town of Kattowitz and is known as the Cleophas mine. All connected works are considered as one mine and this particular group of mines has six shafts, of which three are used for hoisting. The deepest shaft has five levels—at 413, 513, 1108, 1476 and 1673 ft. respectively. The shafts are elliptical in shape, have solid masonry down to the solid rock, which is encountered at various depths from 200 to 500 ft. The mine operates in six seams—the Upper Cleophas, 11.5 ft. thick; the Middle Cleophas, 4.9 ft. thick; the Lower Cleophas, 6.5 ft. thick, and the Cahart seam, 24.6 ft. thick, these constituting the upper measures, while two seams, the Heitzman seam, 6.5 ft. thick, and the Sattel seam, 14.4 ft. thick, are of the lower measures. We have here in one area 68.4 ft. of workable coal, or in

round numbers 70,000 tons of coal to the acre, a quantity hardly approached by any region in the soft coals of our Appalachian field. The coal is uniform in character, extremely hard, mines in large lumps, and would be known in this country as splint coal.

The outside improvements of a German coal mine certainly present an impressive appearance. Brick masonry and steel construction throughout, with presumably artistic designs in all structures, but revolting to the principle of economy in first cost. Starting with a brick wall some 8 ft. in height, with iron gates at the various entrances, the other structures consist of the head frame, always a conspicuous object in the community. In general design these head frames are similar to those of our country, more substantially built, however, by greater weight of steel and broader foundations. The head sheaves are placed in a vertical plane rather than parallel. The power houses are very substantial structures, roomy, handsomely finished inside and scrupulously clean. The tipples and screening house covers a large area and is filled with a mass of machinery, chutes, shaking, knocking and revolving screens with washeries and picking tables closely packed together and attended by over 100 employees. It is to be remarked that the Germans pride themselves on their coal preparation. We grant them this virtue, but practised to excess it adds cost without value in proportion. This fact is admitted, but their claim is that they are in the hands of the heartless consumer, who threatens with little provocation the importation of the better English coal.

BATH HOUSES

The bath house commands attention as one of the principal features of surface equipment. This is a large structure divided into two chambers. On one side are shower baths and on the other side, the larger chamber with very high ceiling, the dressing room and storage room for the clothes. The clothes instead of being put in lockers are fastened by hooks to a chain running to the ceiling or a pulley. A miner is given a key and when the clothes are all hung on the hook he draws them up to the ceiling and locks the chain to the side of the room. These bath rooms accommodate as high as 1000 employees and a shift of 500 men can practically be accommodated at one time. Separate bath houses

are provided for boys and women each. The company maintains in a very comfortably equipped building a kindergarten for the children of the miners, which was at the time of my visit accommodating some 300 children. Teachers and nurses are provided and free milk is distributed, not only to the kindergarten but also to miners' houses for children on request. A laundry is also maintained where the women of the community can bring their washing and avail themselves of hot water, drying rooms and mechanical ironing device, operated without charge to the miners by an employee of the company. Playgrounds are provided for children and parks for men. Company houses are built as flats, fine construction with glazed brick and ornamental fronts. Very extensive rescue apparatus stations are maintained. At the Cleophas colliery, 18 sets of Draeger apparatus, together with other appliances, are kept ready for service at a minute's notice. This station is supposed to serve for three shafts or about 4000 men.

The labor in this part of Germany is as nearly foreign as we find it in our country. Poles and Slavs predominate, with Hungarians, Syrians and some Italians. A large part of the labor does not speak German, but each man is supposed to understand it by law. This latter is largely a matter of opinion and consequently the actual conditions are very similar to our own. Women are extensively employed, but only on the surface; the age limit is 14 years. The miners, as a rule, are devout Catholics, and holidays are fully as numerous as with our miners, and the confusion resulting from it is about the same as here.

WOMEN WORK ON TIPPLES

The women who work on the tipples are of a strong and healthy type and apparently satisfied with their work. During the year 1907 the labor was distributed as follows:

Upper Silesia.	Pct. of Total Labor.	Wages Per Day.
Underground miners.....	52.1	96c.
Other underground work- men	15.4	90c.
Overground men.....	23.2	72c.
Overground boys.....	4.1	28c.
Overground women.....	5.2	30c.
	100.0	

Hoisting engines which are compound have conical drums. With 1000 h.p. they make one lift of 1,673 ft. in 45 seconds. On each trip six mine cars are brought up in three vertical compartments of the cage. Each compartment of the cage has two mine cars in tandem. The landings

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NOTE—Abstract of a paper read before the West Virginia Coal Mining Institute, at its midwinter meeting, Huntington, W. Va.

of the cages are such that all of the loads are taken off together and empties put on; this arrangement is both at the top and bottom of the shaft. About $\frac{1}{2}$ minute is consumed in taking off the empties and putting on six loaded cars. The mine cars are of steel construction with no loose end and can consequently be made tight with no leakage of dust, which, by the way, is considered by the Germans a very important matter. The mine cars are of light construction, narrow gage, and contain about 0.6 of a ton. A car as small as this at first sight does not look right, especially as the limit of the output of the mine is fixed by the capacity of a hoist; but after taking into consideration all the advantages of a small car, and particularly the underground conditions which exist, they are, after all, the best practice, at least so accepted by all the mines of Germany. On the surface they are readily maneuvered in all directions on steel plates without tracks, usually by women. The cars are dumped in revolving tipples, four or more in number for each shaft, the coal passing to the various shaking, knocking and revolving screens necessary for the six sizes which are commonly made and then to picking tables, where each size except the smallest is scrutinized for impurities by six to eight persons, usually women and boys, the empty coal cars finding their way back to their proper deck elevation by elevating chains and gravity track.

The smallest size of coal is mostly consumed by the power plant of the mine, which at this particular mine consisted of 7000 horsepower.

The power distribution about the mine is mostly electrical. Starting with high-tension 300-volt generators in large units, rarely less than 1000 h.p., it is transformed inside the mine to low-tension direct current for electric lights, but wherever possible it is used as alternating current. Motors are used for fans, pumps, and haulage engines inside. Steam-turbine engines have been used for a number of years and are successful and satisfactory in every respect.

This mine has probably the largest pumping capacity of any mine in Germany. One steam pump with 1650 ft. lift delivers 3696 gal. per min.; a five-stage electric centrifugal pump delivers 2640 gal. the same height, while an additional electrical unit of 2640 gal. per min. is being installed, which gives a total of practically 9000 gal. of water with 1650 ft. lift.

THE MINE MAPS ARE LESS COMPLETE

The Cleophas mine is free from gas, is wet throughout, with no visible dust; the haulways are, however, watered each day. The seams are uniform as regards thickness, but displacement faults are numerous. This gives the maps a ragged appearance. Maps, as a rule, are not in

good shape; produced on a small scale they do not show much detail and it leads one to suspect that surveys are not made with the same care and completeness as is done in the best practice in this country.

The levels in each seam are all connected by secondary haulage roads driven in the coal and against the maximum rise about 300 ft. apart; from these secondary haulways, room entries are driven and the rooms worked from these against the rise of the coal, usually to the full height of the seam. The rooms are 20 ft. wide and 40 ft. centers. The upper rooms are worked to the gob. While this is still the prevailing method, it is alluded to as the old method. It has been found that it is dangerous to the workmen, who worked mostly with ladders, and also resulted in a loss of from 40 per cent. to 50 per cent. of the coal due to the fact that the pillars could not be recovered. The more recent method while in general outline and system practically the same as the old, differs in that, when a room is driven, the void so formed is filled completely with a mixture of sand and ashes. The sand and flushing material, which are transported by water, are introduced from an upper level, the room at the lower level being closed in the meantime by a loose double wooden partition with the space between filled with manure. This is for the purpose of holding the solid material and allowing the water to drain off. The material packs very solidly and when the room is completely filled, the extraction of the adjoining pillar is begun at the bottom and the coal completely removed. The weight is shifted from the pillar to the pack material. The latter becomes very hard as soon as it takes the weight, so much so that it is necessary to shoot it with dynamite when the removal of some of it is necessary. As soon as the pillar coal is taken out this void is also filled with *Bergversatz*, as the gobbing material is called. In this way complete extraction of a certain area is made possible and further prevents any considerable subsidence of the surface which otherwise would be inevitable when several such large seams are extracted.

A TENDENCY TO SPONTANEOUS COMBUSTION

Another feature peculiar to this region and remarkable to us is a tendency to spontaneous combustion of the solid coal when exposed to the ventilating current. In fact, it is more than a tendency, rather the rule, for a pillar of coal to fire if not promptly removed or cut from the ventilating system. It has been found that the flushing system is by far the most effective preventive to this danger yet discovered.

To satisfy myself on this and other points by personal observation, I had oc-

casional to enter one of these chambers while in the process of filling. The room had probably been half filled with sand with practically fresh pillar coal on each side. In spite of the water and sand entering rapidly at the normal temperature of the outside air, the temperature in the room was uncomfortably hot, indicating that the process of oxidation had progressed to a considerable degree on the adjoining pillars and required prompt action to prevent its ignition. Still more remarkable is the fact that after this coal has been mined and thoroughly aerated by the screening process it loses this malicious tendency to ignition even though stocked and stored in huge piles for long intervals.

For reasons just stated, it would be advisable to hold the volume of ventilation to a minimum, and this is done to a certain extent. The result is, however, an atmosphere more or less foul, and this with a comparatively high temperature makes the working conditions more or less disagreeable. It is fortunate, indeed, that no gas is encountered, for with coal liable to spontaneous firing and explosive gases, conditions would arise that would appear almost hopeless.

In an adjoining mine at the Ferdinand shaft still another method is employed in the recovery of coal of the thick seam. This consists in taking out the lower bench of coal, say 6 or 7 ft., flushing this space full of sand, then using this as the bottom, working over the same area with another bench of coal and continuing this three or four times, depending on the height of the seam, and finally taking out the adjoining pillar in the same way. The advantages claimed for this are more safety to miners who otherwise would have to work on ladders, and also some economy in timber. It was stated that by putting the post with butt end upward they could be drawn out of the sand and used again in the bench worked above. The claim of such recovery is not, however, largely substantiated and it appears very doubtful whether much economy could be charged to this. The difficulties of this system are evident at once in the various elevations of the bench requiring considerable labor in preparing roads to get the coal out of the rooms. The small light cars minimize this expense, however.

The main haulways, even though driven in the coal on the bottom of the seams, have brick side walls with steel cross beams. In the secondary haulways there is also much steel used for cross timbering. The room headings and rooms have enormous amounts of timbers. Posts in rooms are sometimes 30 ft. long, set 5 ft. apart with cross timbers at the top. Very little of this timber is recovered and the cost of timber alone without the labor of setting it amounts to the equivalent of 25c. per ton of coal recovered. The Upper Silesia field has the

most favorable timber supply of any in Europe. Considerable timber comes from her own area, but a large part is imported from Russia and Austria. Germany is well advanced in the practice of forestry and it is neither expected nor anticipated that the cost of timber in the future will affect the cost of coal very considerably.

Forestry, by the way, as practised in Europe, would be a very profitable and interesting study to the American mining engineer; like many other things, its importance is not appreciated until its practical and successful application has been observed, or driven to it by dire necessity.

The common type of haulways on the level is by endless rope, passing over the cars. On the secondary headings endless gravity ropes are used, by which the loads pull the empty cars. Horses are also used to some extent, particularly in development work, but they are generally replaced as soon as possible by the rope haul. Electric motors have recently been introduced in the level headings and are considered a success. It is doubtful whether electric motors will be so generally used as in our mines from the fact of the small cars and insufficient head and side clearance, which is now their practice, but above all the miserably kept track. It seems as though the condition of track was of the least consideration in these coal mines. It is true that with endless rope small cars do not require very good track and without making radical changes in their track conditions electric locomotives can never expect to succeed.

FIXED RULES FOR TIMBERING

The system of timbering in German coal mines, of which we have heard so much, illustrates most strikingly the methodical manner characteristic of their work. It is evident that for each mine some preconceived rule is laid down that upright posts must be spaced so many feet apart, and that they must be of specified size. Cross timbering is the rule from post to post; with ordinary roof the cross timbering is both parallel with the advancing face, but in most cases the cross timbering is both parallel and perpendicular to the working face. Five feet is perhaps the usual distance between posts. The timber is mostly black pine and posts are wedge shaped or sharpened somewhat at the bottom, the object of this being to give the support a yielding effect without fracturing the post at once when the weight comes on; this practice is common not only in Continental Europe but Great Britain as well. Carrying out the timbering of a room by fixed rule has many advantages but it eliminates the judgment of the individual miner and is certainly extravagant of timber. With roof good, bad or indifferent, the miner places the

specified props at the proper distance and considers his obligation completed with no thought whether the prop is actually needed or whether, judged by the conditions, it is strong enough.

Upper Silesia is the hope of the future fuel supply and it is the field from which any considerable increase of output may be expected. While England may encroach with better and cheaper coal in the seaport trade, Upper Silesia will furnish the bulk of the steam and domestic, with some metallurgical coal for the central and eastern portions of the German Empire.

German Mining Interests in France

SPECIAL CORRESPONDENCE

The chief iron producers in Westphalia and German Lorraine have taken large interests in the iron-ore district of Meurthe et Moselle, either directly or combined with French companies. The well known iron and steel manufacturer, Thyssen, has purchased the extensive concessions of Batilly and Jouaville; the Stumm brothers own the Conflans concession, in the region known as Region des Minettes; the Burbacher Hütte have acquired 589 hectares at Bellevue; Haspe, Hoesch, and Hoerde are jointly owners of the Jarry mine.

Other German companies have preferred to keep themselves in the background and to combine with French firms, so as to be assured of a certain quantity of ore. The Aachner Hütten Actienverein disposes of seven-tenths of the St. Pierremont mine output, where an important shaft is being sunk by the cementing process. The Lothringer Hüttenverein Aumetz-Friede, at Kneuttingen, has made a similar arrangement for four-fifths of the Murville mine output. Mention should be made of the Röchlingenschen Eisen und Stahlwerke at Volklingen a.d. Saar, as representing a most interesting case. This company is, in fact, in co-partnership with the Acéries de Longewy. The latter guarantees the former half of its iron-ore output from its Valleroy mine, and the former company in return guarantees half of its coal output from the "Wurmrevier."

The same may be said of the majority of metallurgical companies on both sides of the border. The companies in French Lorraine import their coke mainly from Westphalia and export important and increasing quantities of iron ore to Germany. The Krupps apparently have not as yet become interested in French Lorraine; on the other hand, they hold an interest in the iron mines in Normandy, where the current ore contracts are said to call for 12,000,000 tons.

The Protection of Boy Labor in Coal Mines

SPECIAL CORRESPONDENCE

The several laws that have been passed in recent years to protect boy labor in the mines, have proved practically abortive through collusion between the parents of the boys and those magistrates and others who were authorized to issue certificates under oath, testifying to the age of the applicant. Probably not in one instance out of ten was the boy the age which was given in the certificate. The consequence was that boys from 10 to 12 years were found working at all hours of the day and night in the breakers, and sometimes in the mines. In recent years something was effected to mitigate this public scandal, but things had reached such a pass that the mine operators coöperated with a number of philanthropists who were interested not only in the boys around the mines, but in all other industries, to have the law passed which is now on the Pennsylvania statute book.

This law provides that any boy who works in the mines shall not be less than 14 for outside work, and not under 16 for inside work, and that the boy shall be able to read and write. A certificate sworn to before a magistrate to that effect, experience shows, would be absolutely of no value to eliminate fraud and perjury. Chief Inspector Roderick, and the inspectors of the various anthracite districts determined that the law for the protection of mining boys at least should not become a dead letter, and that it should be enforced among working boys in and out of the mines.

On Thursday, March 17, Mr. Roderick and a number of mine inspectors met at the Hotel Jermyn in Scranton and after a prolonged discussion, they came to the conclusion that the best way to enforce the law was to see to it personally that every boy working in or around the mines be examined by them individually, in the first place as to whether the boy could read and write; and in the next place, to insure if there was any doubt as to his age, from the appearance of the boy. It was also agreed that the validity of the certificate should be tested by each mine inspector personally in the district over which he has supervision.

It will be an easy matter for the mine inspector to ascertain whether a boy can read and write. He will be taken to the office of the superintendent and examined in a strict, but formal way. If he passes this test, he will then be asked to produce his certificate. If this appears to be doubtful, the boy must bring his baptismal register with him when he comes to work.

Eliminating Dust from Anthracite Breaker

For Less Than \$6000 a Dust-collecting System Can Be Installed,
Resulting in Fewer Accidents and Increasing the Operating Efficiency

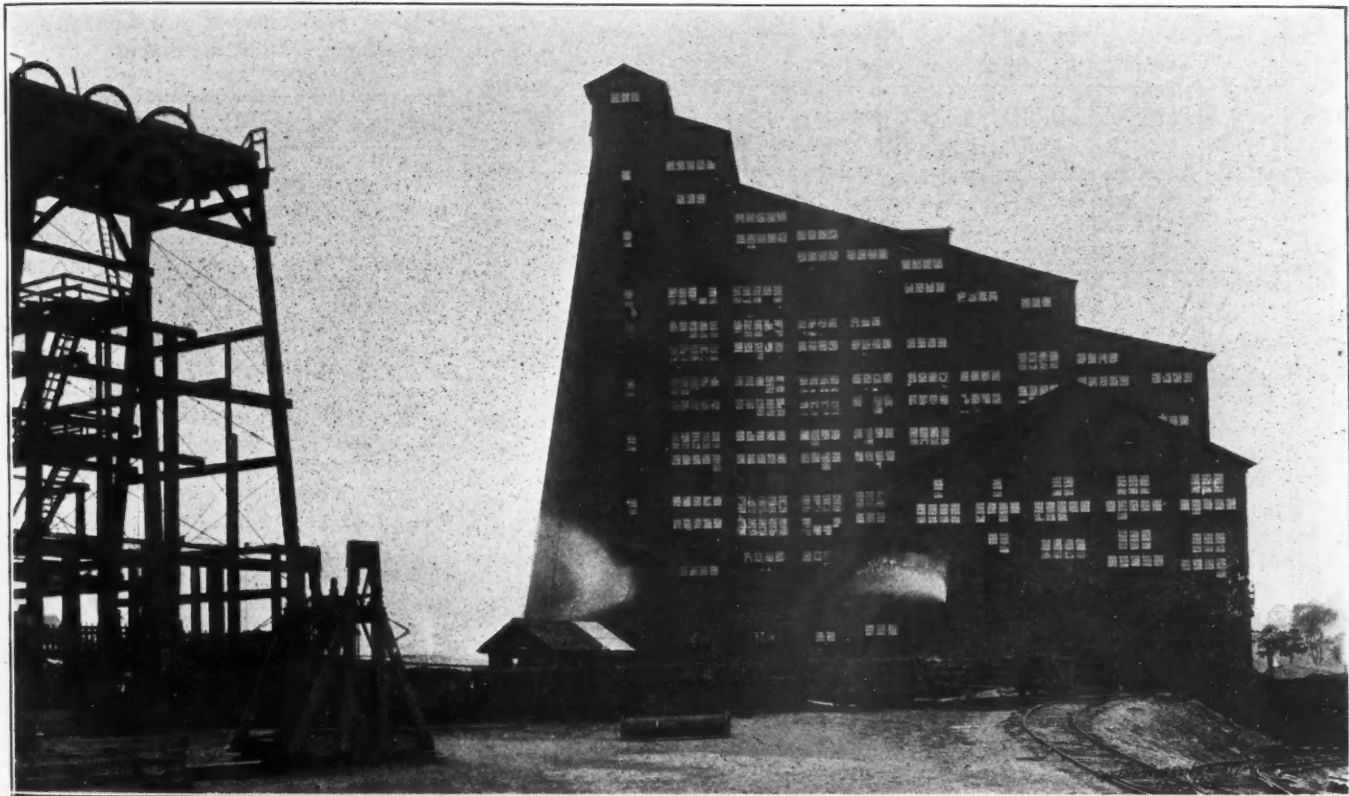
B Y J. J. J O N E S

The preparation of anthracite coal for market requires screening for sizing and crushing to separate the refuse from the coal. This treatment results in the production of a large amount of dust, which materially interferes with the men employed in the breaker and also with the action of the machinery. The elimination of this annoying dust is one of the present breaker problems. During eight months of the year, a large volume of this dust usually finds its way through

Recently B. G. Carpenter & Co., of Wilkes-Barre, Penn., obtained a patent on a device which practically eliminates all dust. This system is simple as well as cheap and easy to operate. It consists of a fan, air ducts and separating chambers as shown in the accompanying diagram, which is a sketch of the device as installed at the Maxwell colliery. An installation of this system requires air-tight housing of all the machinery from which the dust rises, with a

made by a bone roll is considerably heavier than that made by a coal screen. The specific gravity of the coal dust is $1.52+$ while that of the dust made at the bone roll has a specific gravity of from 1.60 to 2, the average being 1.80; as a consequence, the latter dust requires more force to draw it through the pipe than the former.

The diameter of these air ducts as installed at the Maxwell breaker is 20 in. and that of the main suction pipe is 76



SHOWING THE MAXWELL BREAKER IN FULL OPERATION AFTER THE INSTALLATION OF DUST ELIMINATOR.
DUST CLOUDS PREVENTED A PHOTOGRAPH BEING TAKEN BEFORE THE ELIMINATOR WAS INSTALLED

the cracks and windows into the open air. If the breaker is built in the neighborhood of a town or city, it creates inconvenience, annoyance and is a public nuisance to the community, to say nothing of the depreciation of real estate about the breaker.

When there is no current of wind, about 75 per cent. of this breaker dust settles within a radius of a few hundred feet. But on a windy day, the dust is often carried several miles before it is deposited on the ground. To eliminate the dust nuisance several schemes have been tried at different breakers, but so far the devices have not been effective.

removable partition to admit of occasional cleaning and repairs. The housing is connected to a hood and then to the suction pipe of galvanized steel, through which the dusty air is drawn by a fan, 12 ft. in diameter and 6 ft. in width, having a speed of 150 r.p.m., which produces about 120,000 cu.ft. of air per minute.

The diameter of the air ducts varies according to the length, number of curves and the kind of dust to be drawn through. All the suction pipes are so designed that each has an equal resistance against the current of air. Another thing to be considered in this connection is that the dust

in.; the fan is connected to the shaft by means of a belt. The fan forces the air into the vertical chamber, which latter has dimensions of 10x12 ft., and is a rough, air-tight wood structure with a number of deflecting vanes attached to both sides of the chamber with an angle of 45 deg. to the vertical. The vanes are made of rough yellow-pine boards. This roughness gives more surface area as well as being a better retainer of water than smooth boards. At a convenient point above the upper vane, exhaust steam from the breaker engines is introduced to dampen the air besides two water sprays which are attached to the

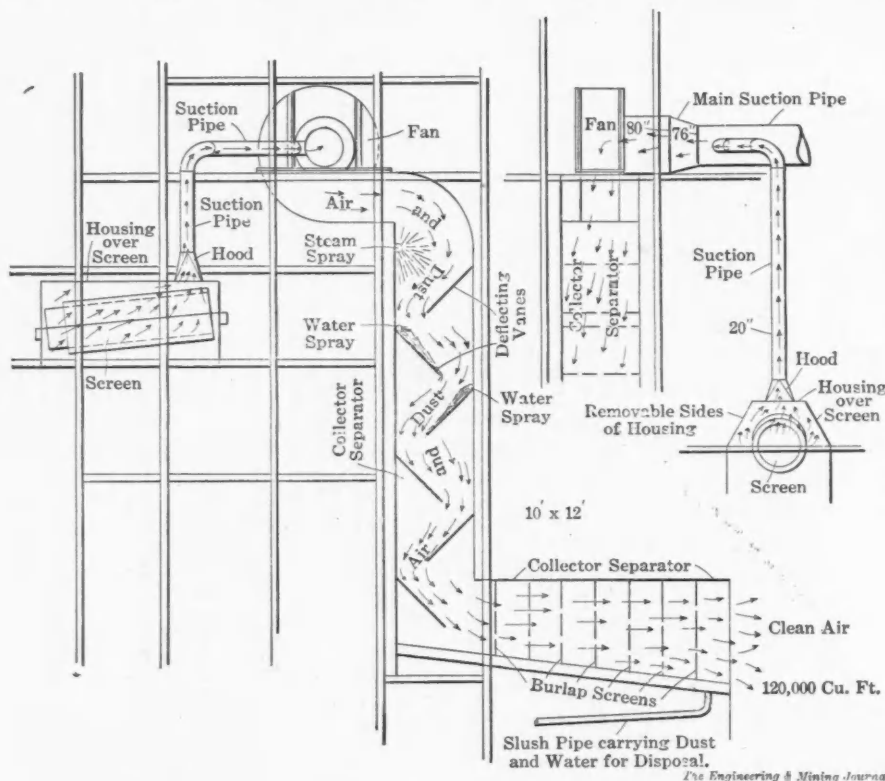
two upper vanes as shown on the sketch. The diameter of the water pipe is 2 in. The water is pumped up by the breaker pump and flows out at the upper spray with a head of 15 ft. When the water reaches the foot of the chamber it is loaded with dust.

There is another horizontal chamber which is connected at the foot of the vertical separator, in which the minute particles of dust that have not been taken up by the first separation are caught by means of burlap screens upon which the air gives up its moisture as well as its last traces of dust, and a mixture of the dust and water in a semi-liquid form drops down to the bottom. The water thus collected from this and the former separation is piped to a slush hole and

that is scattered by a breaker in operation will readily see the benefit to health, cleanliness and beauty of this simple method of elimination of dust as illustrated by the above photograph. Moreover, an installation of the system in a breaker gives a large return for a small investment, in that the removal of the dust from the interior of the breaker keeps it clean, and no extra men are needed to sweep the breaker floors after a day's work; the cost of illumination is reduced; better preparation of coal is secured because the clear atmosphere permits the workmen to more closely watch each operation, and consequently the amount of condemned coal is reduced to a minimum; accidents are minimized and the health of the men is improved;

the Temple and Iron Company; Dorrance colliery of the Lehigh Valley Coal Company; the No. 5 colliery of the Susquehanna Coal Company, and the New Diamond colliery.

Heretofore little has been understood about the production of dust in the anthracite fields. The engineer at the Maxwell breakers has estimated at various times the quantity of the dust removed by the Carpenter system. It varies from 20 to 40 tons a day. Taking the minimum figure for the basis of an estimate for the production of dust in the entire anthracite coalfield, where about 320 collieries are operated an average of 230 days in the year, it is evident that each breaker produces 20×230 , or 4600, tons of dust, and 320×4600 , or 1,472,000, tons of dust for the entire field. In 1909 there were about 71,000,000 tons of coal mined, of which 61,969,428 tons were shipped and marketed. From these figures it is obvious that the production of dust amounted to about 2 per cent. of the output.



GENERAL DESIGN OF SCHEME FOR ELIMINATING DUST FROM AN ANTHRACITE BREAKER

flushed with the culm into the old workings.

ONE GALLON OF WATER MOISTENS 6 OZ. OF DUST

The inventor of this system made a test as to the amount of dust that the water would take. He found that 1 gal. of water moistened 6 oz. of dust, or a capacity of about $4\frac{1}{2}$ per cent. According to the above calculations, if a breaker produces 20 tons of dust a day, the amount of water required to eliminate the dust is about 12,000 gal. The accompanying photograph shows the Maxwell breaker in full operation after the installation of the dust eliminator. Before the dust was cared for in this manner, the breaker was enshrouded in one black-dust cloud.

Those who realize the amount of dust

the machinery operates with less wear, the use of lubricants is lessened and the life of belts and ropes is lengthened.

The cost of installation of this system varies at different breakers; much depends on the internal arrangements of a breaker and the location of the fan. But it may be said in this connection, that the following is the approximate cost:

COST OF INSTALLATION.

Fan air ducts, etc.	\$4,000
16,000 feet lumber	460
Labor	700
Concrete, piping and steam connection	300
Total	\$5,460

Besides the Maxwell breaker, many other breakers in the anthracite field have installed the system. Among them are the Hollenback and National collieries of the Delaware, Lackawanna & Western Coal Company; the Harry E. colliery of

In considering the dangers that accompany the accumulation of dust in a coal mine, it is quite possible that a small amount of dust is more dangerous than an excessive quantity. Experiments should be conducted to determine whether or not a large quantity of dust present in a mine will have a choking effect.

An English engineer, basing his opinion upon experience, says: "In coal seams lying horizontally, or only slightly inclined, steel mine cars are best and last a long time without any considerable cost for repairs; however, where the coal seam is inclined, wood cars are preferable, by reason of their necessary frequent renewals or repairs caused by the breakages general in these seams."

The Lehigh Valley Coal Company is preparing to start work on a new breaker at Mahanoy City, Penn. This breaker will be run by electricity, and will be the first of the kind in the southern anthracite coalfield. The slate will be separated from the coal by means of magnesium tables, which by the principle of friction clean the coal more effectively than the jigs and separators now in use.

In all mines using horses or ponies underground, a "wash" should be provided as close to the stables as possible. Some horses positively revel in the water, while it is of incalculable benefit both to them and to the stable-keeper. After a day's work, the dirt and clay adhering to the bodies of the horses should be washed off. The "wash" should be 10 yd. in length, 6 ft. wide, in dish form, being 30 in. to 3 ft. at its lowest part. It should be planned with a traveling-way at one side for the drivers. The water should be changed every day.

COLLIERY NOTES

i PERSONAL i

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

J. W. McAllister, of Greenwood, B. C., is visiting New York.

Daniel Guggenheim returned to New York, March 26, from Europe.

Alfred James has gone to Mexico, where he will remain about six weeks.

Robert T. Hill has gone to London, whence he will return in about 10 days.

Henry S. Washington expects to return to New York from Brazil early in May.

Dr. James Douglas has gone to Arizona, expecting to return in the latter part of April.

J. Volney Lewis, New York, is examining some mining properties in the western part of North Carolina.

Edwin E. Chase, of Denver, Colo., is in the State of Sonora, Mexico, examining some copper properties.

Royal A. Smith, president of the Live Oak Development Company, has returned from Duluth, Minn., to Arizona.

Franklin Leonard, Jr., has been elected president of the Ophir Mining Company, of Nevada, in place of Charles H. Fish.

James MacNaughton, general manager of the Calumet & Hecla, has returned to the mines after an extended sojourn in Florida.

John Knox, Jr., in charge of the underground work for the Calumet & Hecla Company, underwent an operation for appendicitis recently.

George G. Hackstaff, manager of the Kansas-Mexico mine at Parral, Mexico, is on a trip to Denver and other points for the purchase of mine equipment.

Addison H. McKay has resigned his position as president of the Mercantile Banking Company of the City of Mexico, to devote his entire time to his mining interests.

David Jones has been appointed mine superintendent for the St. Clair district of the Philadelphia & Reading Coal and Iron Company, in place of the late Thomas Beddow.

C. E. Abbott, formerly chief engineer, has been appointed general superintendent of the Ore Mines division of the Tennessee Coal, Iron and Railroad Company, with headquarters at Bessemer, Alabama.

The Rhodesian government has decided to appoint a medical committee for the purpose of inquiring into and reporting upon the prevalence of pneumonia and scurvy in mines, and to make such recommendations as it may see fit for the prevention of these diseases. Drs.

W. G. Clark, A. M. Fleming and Macaulay comprise the committee.

+ OBITUARY +

Sidney W. Tyler died in Denver, Colo., March 27, aged 69 years. He was born in Windham, Conn., but had lived in the West for a number of years, and practised as a mining engineer and geologist in Colorado and elsewhere.

William Barnsdall died at Bradford, Penn., March 27, aged 56 years. He was born in Titusville, Penn., and when a young man engaged in the oil business, removing to Bradford in 1880. In connection with his father, William Barnsdall, Sr., and his brother, Theodore N. Barnsdall, of Pittsburg, he conducted some extensive operations, and was widely known in Pennsylvania and elsewhere. He was secretary and treasurer of the Manufacturers' Gas Company, of Bradford, of which his brother, T. N. Barnsdall, is president. He was interested in the Union Natural Gas Company, of Kansas; the Kansas Natural Gas Company; the Dominion Gas Company, of Canada; the Potter Gas Company, of Pennsylvania; and was identified largely with the Northern Oil Company, whose holdings are chiefly in Elk county, Penn. He had other interests also, and was an active and successful man. He leaves a widow and one son.

Hugh McDonell died at his residence in the City of Mexico, March 22, aged 57 years, after a short illness. He was born in Allegheny, Penn., but when a child removed with his parents to Missouri, where he was educated. In 1879 he went to Leadville, Colo., and engaged in mining. From that time on mining was his occupation and profession, and he was actively engaged in it in Montana, California and Alaska, as well as in Colorado, becoming an expert whose advice and opinion were sought in many quarters. About 1902 he made a long trip to Europe, visiting a number of mines in Spain, Sweden and Norway. On his return from Europe, he settled in Mexico, and soon became one of the best known mining men in the Republic. He was successful in his Mexican operations, and owned the Rincon mine at Temascaltepec, besides being interested in other operations. He was a prominent member of the American Club in Mexico. He leaves a widow and a nephew, Bernard McDonell, who is superintendent of the Rincon mine.

SOCIETIES and TECHNICAL SCHOOLS

American Institute of Chemical Engineers—The summer meeting of the institute will be held at Niagara Falls, N. Y., June 22-24, next. A prominent feature

of the meeting will be visits to the interesting chemical industries in that locality. An important program of papers is being arranged for by the committee on meetings.

Utah Society of Engineers—The regular monthly meeting was held at the society's room, Newhouse building, March 18. H. P. Saunders read a paper on "The Concentration of Ores," which was followed by an informal discussion. J. H. Tempest, J. P. Marshall, H. W. Shiley, and W. L. Emery were elected to membership, and arrangements for the annual banquet were made. Benjamin F. Tibby has been appointed treasurer to fill out the unexpired term of John C. Hornung, who resigned owing to moving from the State.

Australasian Institute of Mining Engineers—At the annual meeting at Melbourne, Victoria, Jan. 31, an increase of 49 members during the year was reported, making the total number 375. The new president chosen was G. A. Richard, Mount Morgan, Queensland; with Richard Hamilton, Kalgoorlie, Western Australia, as vice-president. Members of Council chosen were: Stanley Hunter, A. S. Kenyon, A. H. Marrin, Victoria; G. D. Delprat, Vincent F. Shallcross, New South Wales; W. H. Corbould, Queensland.

Mining Society of Nova Scotia—The eighteenth annual meeting was held at Halifax, March 15 and 16, closing with the annual banquet on the evening of March 16.

The papers to be read at the meeting were:

"Description of Haulage System at Nos. 3 and 4 Collieries of the Nova Scotia Steel and Coal Company, Sydney Mines," by John Johnston.

"Notes on the Use of Explosives and the Methods of Shot Fring," by C. E. Coll.

"The Commercial Value of the Oil Shales of Eastern Canada," by Dr. R. W. Ells.

"Description of Electric Endless Haulage at Colliery No. 5 of the Nova Scotia Steel and Coal Company," by Robert Robinson.

"Tungsten Deposits at Moose River, N. S.," by E. R. Faribault.

"Use of Low-grade Fuel under Boilers," by John Preston.

"The Clays of Nova Scotia," by Professor Ries.

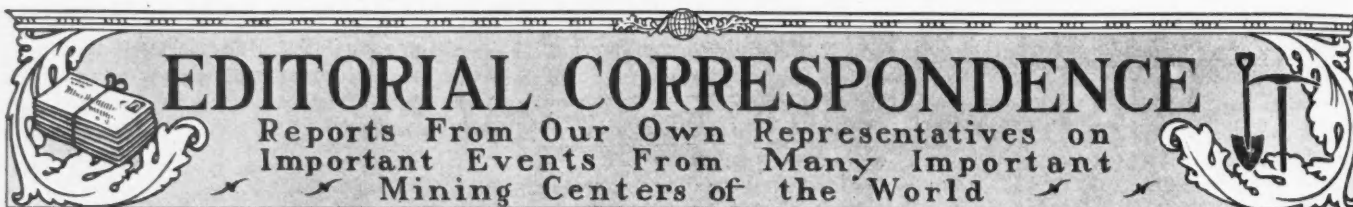
"Blast Furnace Stock-handling and Charging Apparatus," by W. H. Graham.

"Treatment of Boiler Water," by A. L. McCallum.

"Scheelite at Moose River, N. S.," by A. A. Hayward.

"The Use of Coke Oven Gas as a Fuel," by T. J. Brown.

"Practical and Economic Mining," by Neil A. Nicholson.



EDITORIAL CORRESPONDENCE

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

San Francisco

March 25—Some exceptionally rich strikes have lately been made in both quartz and gravel in different parts of California. The most notable, perhaps, is that made by Ah Kai and his Chinese associates on a lease on Jerry Goodwin's ground at You Bet, just across Bear river from Dutch Flat, Placer county. The patch of ground had been overlooked by former white miners because it could not be hydraulicked, but the Chinese ran a short tunnel and struck the old river bed, taking out \$204,000 in a short time. Many Chinese operate in that section, working by crude methods, but no extensive operations are carried on by whites, owing to the hydraulic-mining laws preventing them. The Chinese are satisfied with lower wages and poorer ground, but occasionally strike into rich patches. There are thousands of acres of auriferous gravel in that section of Placer county which are not being worked because the laws regulating hydraulic mining are so rigidly enforced by the California Débris Commission that to build impounding works, dams, etc., is both expensive and risky. The continued operation depends on the will of the members of the commission, who have the power to close down the mine at any time they think an excess of débris is permitted to pass out of the dam.

From the Crystal quartz mine at Angels, owned by James V. Coleman, of San Francisco, a \$200,000 "pocket" has just been taken within a short time. This was found in the ordinary working of the mine. The Tarbot mine, three miles from Angels, has also just yielded a pocket of \$10,000. At the Standard mine, Sailor ravine, near Downieville, exceptionally rich rock is being taken out. This is at least 10 miles north of Alleghany, where so many rich strikes have been made. It is now considered that there are great possibilities in the mineral region lying between the Standard mine and Alleghany.

The annual meeting of the United States Diamond Mining Company was held at Oroville recently, and after the auditing committee had reported that the accounts were correct, a resolution was adopted to close down the mine indefinitely and the manager was so instructed. This is the enterprise started a few years ago by M. J. Cooney and associates to open ground near Oroville, supposed to contain diamonds. Some small diamonds had been found in years past in the hy-

draulic mines of that region, and favorable indications were supposed to be found in the ground located and purchased by this corporation. A good deal of development work has been done during the operations of the company, but no diamonds of value have been found. Hence the decision of the directors to quit further prospecting. The company, however, keeps itself in existence, and has elected a board of directors, of which M. J. Cooney, of Oroville, is president.

Work is being advanced rapidly on the baghouse at the Mammoth Copper Company, at Kennett. The cement foundations are completed, and the steel structural material is on the way. The building is to be completed in a specified time in accordance with an agreement with the farmers of the county. In the same county, the Balaklala Copper Company is experimenting with the Cottrell process for condensing fumes, which is used by the Selby Smelting and Lead Company. Some late improvements are to be introduced.

The Union Copper Company, Copperopolis, has transferred all its holdings to the California Copper Company, and the latter has given a mortgage to the State Trust Company of Boston to secure a 6 per cent. bond issue of \$450,000 to be spent in operating the mine and plant on a large scale.

The litigation between O. E. Cheeseborough, S. W. Looney and Tarkington over the Tarkington mining property in the Radamacher district of Kern county has come to an end. While the case was being heard in court at Bakersfield, Tarkington, the virtual owner, admitted that he had not done the annual assessment for the past two years. This news was telegraphed to Searles, and the claims were immediately relocated by parties who had nothing to do with the suit.

Crocker, Greenwood and other San Francisco capitalists obtained some years ago a valuable mining concession from Nicaragua, for the proper operation of which a railroad connecting Managua with the coast was essential. The railroad concession was granted by Ex-President Zelaya and a first payment of \$25,000 made. It appears that Zelaya did not fulfil his part of the contract and a suit has been filed in the Federal Court at New Orleans to substantiate the rights of the plaintiffs before the Nicaraguan government.

The right of a foreign corporation to condemn lands for a right of way for a ditch line was decided in favor of the foreign corporation in a recent decision.

The defendant was the Sacramento Irrigation Company and it was claimed that only domestic companies possessed the right of condemnation.

Miners and prospectors operating along the line of the Oregon-California Railroad will be pleased to learn that the Department of Justice has sent a report to the United States Senate, stating that proceedings have been instituted to recover lands sold under that company's grant. The conditions of the grant are said to have been violated in the sales of part of some 820,000 acres of land. The company still has over 2,000,000 acres of land unsold. No doubt many acres of mineral lands have gone out of the mineral domain on most of these railroad grants because no segregation of agricultural and mineral lands was made by the Government as should have been done. The grants excepted the mineral lands; but when there was no one to protest, these went to patent with the other lands and could not be recovered for the miners. All over the Pacific coast the railroads are now owners of mineral land to which they really had no legal right in view of the wording of their grants from the Government.

The Noble Electric Steel Company, which has for some months been operating an electric fuel plant on the iron ores at Heroult, Shasta county, is about undertaking a similar experiment in the Minaret region of Fresno county. The company has some 17 claims in that section and has sent men to work upon them though the snow is still deep in the mountains. The Minaret region is supposed to hold the largest iron-ore deposits on the Pacific coast, but they have never been developed, owing to distance from transportation lines and lack of local deposits of fuel.

A site has been acquired at the upper end of Oakland harbor, San Francisco bay, to establish a graphite factory. The Alaskan Graphite Company, of which S. J. Philpotts is president, has acquired large holdings of graphite deposits in Alaska, and it is this company which is establishing the factory. The material is much the best in quality which has thus far been found on the west coast of the United States, and is said to be in abundant quantity.

A suit as to title of a magnesite mine in western Sonoma county has been going on the past week, in which is involved the proper marking of a claim by monuments when the location was made. George Madera, of Healdsburg, and the

Western Carbonic Acid Gas Company are the plaintiffs, and the defendant is the Sonoma Magnesite Company, of which A. B. Davis *et al.* are owners. The judge denied the motion for a nonsuit, and held that there was some evidence showing that monuments had been set up in locating the mine by George Madera some years ago.

The Pacific coast only uses 5000 to 6000 tons of this magnesite annually, and it has thus far been found impossible to ship any East and compete with magnesite from the Grecian and Austrian mines. There are many deposits of magnesite in California, but only a few are being worked, and they are the ones which lie near railroads.

Goldfield

March 26—Work on the Goldfield-Ely railroad will commence within a few weeks. Contracts for the grading between Goldfield and Tybo have been let, the final location having been decided upon between these points. A new survey is to be run from Tybo, through Hamilton to Ely and thence through Cherry creek and Deep creek into Salt Lake. The company is contemplating a tunnel a mile in length through the north end of White Pine mountain which will shorten the road materially. It is expected to have the road from Goldfield to Hamilton in operation by fall.

Butte

March 23—The American Smelting and Refining Company's plant at East Helena has offered a new arrangement by which the smaller shippers along the Lake Pend d'Oreille district will be enabled to ship with greater frequency. It has been the habit of the smaller shippers to wait until they had a railway car of ore before shipping, so that they might take advantage of the relatively low carload rates, and for that reason many properties have not been worked because the owners could not get the necessary grubstake to last them until they got returns. The company now offers to get all ore which has been sacked and give the shipper the benefit of carload rates, even though the ore be less than a carload, and assures shippers that remittances will be received within two weeks from the time of shipments.

The attempt of the Davis-Daly Copper Company to build a tramway from its Colorado shaft through the streets of Butte to the Great Northern Railway tracks continues to meet with much opposition. When the city council was considering the advisability of granting the company that privilege, the owners of the property along the proposed tramway attempted to enjoin the council from granting that permission, but the local district court held against them. Now that the actual construction work has been begun,

the property owners have instituted action seeking an injunction against the company itself. The property owners' contention in the present suit is that the proposed tramway will depreciate the value of the adjoining property and that no provision has been made for compensation.

The Central Trust Company, of New York, has brought suit in the Federal circuit court in Helena against the Montana Coal and Coke Company and the International Trust Company to foreclose a mortgage given in 1900 to secure a \$500,000 bond issue. This is the second action of a similar nature against the coal company, suit having been brought a short while ago by the International Trust Company to foreclose on a \$400,000 bond issue made in 1907.

The hearing of the Government's protest against the application of James W. Murphy and Maurice Eisenberg for patent for the Golconda quartz-lode mining claim is now being heard in Butte. The claim is a few miles west of Butte and near the British-Butte property. The facts are much like those involved in the British-Butte controversy with the Government on the patent of its claims, which was recently decided against the Government.

Denver

March 26—Much interest centers in the suit for \$1,000,000 brought by the Doctor-Jack Pot Mining Company, of Cripple Creek, against the Work Mining and Milling Company now before Judge Lewis in the U. S. circuit court. The Work company owns the Little Clara, which is very rich, and has made a heavy production, but the plaintiff company claims that the apex of the Little Clara is on the Lucky Corner claim, which is the property of the latter company, and the suit is to recover the value of the ore alleged to have been extracted from the Little Clara.

The original orebodies of the Rico-Aspen group and the Enterprise mine, which were later consolidated under the name of the United Rico Mines Company, were in vertical fissures in the sandstone, and terminated at the overlying shale under which the ores were deposited for a considerable distance on either side of the fissures, forming continuous shoots on their strike. All the metal extracted hitherto came from these shoots, but they have been practically worked out and the only hope of future success would appear to be to follow these shoots into the mountain. The Atlantic-Cable, acquired by the same company, is a horizontal deposit in the flat at the foot of the same mountain, and in the townsite of Rico, at about the junction of Silver creek with the Dolores river; and in this have been proved large bodies of zinc-lead sulphide, the mining and separation of which have not been an unqualified

success. Drill holes have proved the limestone sheet to be mineralized close to its contact with the underlying quartzite, and it is a fairly promising prospect if properly opened up.

Salt Lake City

March 26—There has been some talk recently of a shortage of ore in the Salt Lake market but this reported shortage appears to have been regarded as greater than it actually is. The supply is not much less than normal for this season of the year. The poor condition of the roads and some loss in shipments to the valley smelters from southern Nevada camps, due to the washouts on the Salt Lake railroad, have had some effect on the market.

The United States Smelting and Refining Company has six lead furnaces in blast at Midvale, which is all of its lead furnaces. The American Smelting and Refining Company is running six furnaces on lead ores at Murray, and one furnace on matte concentration, making a total of seven out of eight furnaces in operation.

Park City is shipping an increased tonnage over the winter months. Bingham is producing about as usual; some ore is ready for shipment by leasers as soon as the roads are in better condition. A few mines in the Tintic district are not producing as heavily as before, but, owing to new properties shipping, the district production is normal, or even larger than usual at this season. Practically no ore is coming from the camp of Alta, owing to snowslides which have blocked the aerial tramway, and to the poor condition of the roads in Cottonwood cañon. Beaver county has shipped little ore this year, though some mines are preparing for an increased production during the spring and summer.

There is not over 10 per cent. less ore than usual being shipped to the valley plants. The deficit is largely in gold and silver ores from Nevada, with some decrease in lead. The winter has been severe, and many small properties and leasers have been unable to ship. It is expected that during May, June and July the production and are shipments will largely increase.

The greater part of the land along the Grand river in Utah and Colorado, withdrawn by Secretary Garfield with a view to protecting any power sites it might be found to contain, has been restored to entry. The remainder, following an examination by the U. S. Geological Survey has been incorporated within a power-site withdrawal.

Recently work has been started by the Utah Conservation commission on a new map showing the natural resources of the State. The map will be 4½x6 ft., and will indicate by colors and characters the irrigable and nonirrigable land,

agricultural land, mineral land, including mining districts and the character of the ores, the mean temperature, rainfall and precipitation in different sections of the State, topographical features and other information. The average flow of streams, drainage area, elevation along streams, run off, etc., will be incorporated in tables to accompany the map. State roads, railroads, reservoir sites, public, private and State land, forest reserves, and as much information as possible without overcrowding the map will be given. At a meeting of the commission recently held in the office of Gov. William Spry, details of the map were outlined by H. P. Poll who has been authorized to draw it. The map will be the most complete that has been made of the State. The commission has announced that copies of the preliminary report recently issued may be had by addressing the clerk of the commission at the office of the governor. The report is a preliminary outline of the resources of the State.

At a meeting of the Silver King Coalition directors, March 17, it was decided to pass the quarterly dividend as it would be necessary to curtail mining operations for a month in order that a part of the shaft might be retimbered. While this is being done, arrangements will be made for electric haulage, covering about three miles of workings. Attention was called to the fact that the company was the sole owner of more than 2000 acres of patented mining ground, and in addition owned an undivided interest in two claims known as the Conkling and Arthur. The company also owned an interest in the Kentucky group with the Uintah Treasure Hill company as co-owners. The company also owns an undivided half interest in the Vesuvius, Andes, Custer, and Delaware claims in which the Silver King Consolidated owns an undivided one-half interest. The statement adds that suits in partition are now pending in the United States court with each of the above-named companies. It was therefore considered advisable to further add to its surplus in order that the company may be in a position to purchase the interest of its co-owners, should the property involved in the several suits be directed to be sold under the decrees of partition. Whether it would be advisable to sell or purchase as given in the statement, can only be determined when the time of sale arrives. In closing, the statement adds that dividends, unless something unforeseen occurs, will be resumed. The statement notifying stockholders of the passing of the quarterly dividend refers to one phase only of the suits which are pending against the company. The probability of judgments for ore alleged, and in one suit admitted, to have been taken from jointly owned ground, is not mentioned.

Toronto

March 25—This week a deputation of the Canadian Mining Institute including T. B. Caldwell, Lanark; Col. A. M. Hay, Haileybury; H. Mortimer Lamb, Montreal; G. G. S. Lindsey and Professor Willmott, Toronto, waited on Premier Sir Wilfrid Laurier at Ottawa and urged several important changes in mining laws. These included the placing of the issue of mining titles and the administration of mining laws in regard to lands under federal control, in the hands of the Department of Mines, and the consolidation and codification of the Dominion mining laws, now in a state of confusion. Hon. W. Templeman, Minister of Mines, indorsed these proposals and the Premier intimated that they would be carried into effect. A subcommittee of the Mines Committee of the House of Commons has been appointed to draft a bill consolidating the mining laws.

Several of the Cobalt ore-stealing cases for which a large number of arrests were made last December were brought to trial here this week. In the cases of Nicholas Zojatz and James Connolly, *alias* Parr, the juries disagreed. George Barber was convicted on the charge of selling ore without authority. T. C. Robinette, counsel for the prisoner, thereupon asked for a stated case to be presented to the High Court. He claimed that the prisoner could not be found guilty under the act, which referred to the sale of ore, whereas the evidence tended to show that the sale was made after the ore had been refined and was therefore a sale of silver and not of ore. As the other cases yet to be tried turn on the same point, they were traversed to the next sitting of the court pending the decision of the High Court on the question.

Cobalt

March 26—One of the biggest deals that has yet been put through in the Porcupine district was consummated a short time ago, when Eastern capitalists, headed by C. L. Dennison, president of the Buffalo mine in Cobalt, purchased the Wilson-Edwards properties. The Wilson vein is generally conceded to have the most sensational surface showings in that section, and is to a great extent responsible for the rush that ensued. A plant, including a 6-drill compressor, is on the way and effort is being made to get the material in before the break up. Good reports continue to come from the properties that are being developed, and the work uptodate is promising. A carload of ore has been sent out from the Timmins property, on which a mill test will be made. Additional areas of gold-bearing formation have been located in the townships of Bryce and Holmes.

During April, six Cobalt mining com-

panies will distribute dividends amounting to \$970,293. Uptodate for the present year nine companies have paid and declared in dividends \$2,324,527. This does not include the profits returned to the owners of the privately owned companies, the O'Brien and the Drummond. Of the dividends the Nipissing contributes \$900,000 and the La Rose \$300,000.

The Cobalt Gem nugget, which is the largest piece of silver float ever found in this district, has been purchased from the owners by the Ontario government for \$5054. The nugget weighed 1640 lb. and was 40.62 per cent. pure silver containing 9715 ounces.

The Lewisohn interests, who control the Kerr Lake mine in Cobalt, have made the second payment on the Wetlaufer mine, South Lorraine. This gives control of the property, which will now be opened up directly under this management. The work accomplished has demonstrated the value of the property and the ore in the lower levels is as good as near the surface. A 12-drill compress has been purchased. The Wetlaufer is the best developed and most important mine in South Lorraine and its purchase by the Lewisohns will give a considerable impetus to mining operations in the district.

From all appearances the Mines Power, Ltd., will be in a position to deliver air and electricity very soon. The steam-generated power costs on the average about \$175 per horsepower-year. The electric energy is to be sold for \$50 per horsepower-year, while the air will be sold at 24 to 25c. per 1000 cu.ft. of air compressed to 100 lb. pressure. The Cobalt Power Company promises delivery in April. The Hydraulic Air Company has some work to do yet.

An option has been given to New Liskeard men interested in the Hudson Bay mine at Cobalt, on the McAlpine properties at Shanty Lake, Gowganda. Several veins have been found, some of which show native silver. The shipments from Gowganda now amount to 300 tons.

Mexico

March 25—The new American ambassador for Mexico, Henry Lane Wilson, has arrived at the capital and is now in active charge of the diplomatic office. The mining interests, while not directly concerned with the matter of diplomatic representation with the Republic, have nevertheless a lively indirect interest. It is expected that Mr. Wilson will be very satisfactory in connection with this important post.

It is reported that the London Exploration Company will close its option for the Sierra Morado mine in Guerrero. The same interest is also considering the Tiro General property at Charas, S. L. P., and has options in the Sta. Eulalia district, Chihuahua, and in the Concepcion del Oro district, Zacatecas.



THE MINING NEWS

Reports of New Enterprises, New Machinery,
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General Mining News

American Smelters Securities Company

The common stock of this company consists of 300,000 shares, of which 177,510 are owned by the American Smelting and Refining Company; the remainder by the Guggenheim Exploration Company. Among the other assets of the company are the Garfield smeltery, which is said to have cost \$6,000,000; and the Baltimore refinery, for which about \$4,000,000 was paid.

Arizona

COCHISE COUNTY

Calumet & Arizona—At the Irish Mag, No. 3 raise on the 550 level has struck ore.

Superior & Pittsburg—Prospecting of the new high-grade sulphide orebody on has shown the vein 15 ft. thick. Preparations have been made to run an incline raise on the vein to the 1300 level. Sinking has commenced at the Briggs shaft from the 1200 down.

Mascot—This copper company near Wilcox has installed the largest distillate engine in the world, which will run an Ingersoll 10-drill air compressor. The east crosscut on the property is in 200 ft. and has cut three veins 25, 10 and 17 ft. in thickness. The company has developed a large tonnage.

Tombstone Consolidated—Since the middle of February the mine has been unwatered from 900 to 955 ft. The large pumps will be uncovered in about 40 ft. more.

Arizona Commercial—The smeltery was treating about 210 tons of ore daily from the fifth and sixth levels. Drifting in the Black Hawk vein at the seventh level has advanced 300 ft. westward from the point 40 ft. from the Eureka shaft, where the vein was opened by the crosscut. Some good ore has been opened by this drift, and raising will be begun from there to the intermediate level above, where the drifts encountered some of the best ore yet extracted from the mine. The pumps are raising about 2,500,000 gal. of water every 24 hours. Owing to an accident, the smeltery has closed down temporarily.

GILA COUNTY

Keystone—The stock of this company has sold off lately in the New York market, but from the office of the company no news about it has been given out, and when asked it was said that there is none

to give out, but probably a report of developments up to date will be made upon Mr. Channing's return to New York, which will be shortly after the middle of April.

A correspondent at Globe reports to us under date of March 30 that although Keystone management refuses to make any statement of results of development work and refuses to allow anyone except employees to go underground, it is generally understood that the level work and churn-drill operations are making a favorable showing. According to best advices, probably conservative, the known orebody is 800 ft. long, 400 ft. wide and 100 ft. thick. Average copper contents is probably about 2 per cent., or slightly less. About 60 men are employed in development, chiefly on the 250-ft. level. The churn drills are at work on Philadelphia claim, about 900 ft. northwest of shaft.

GRAHAM COUNTY

Gold Crown—This El Paso company is operating in the Graham mountains, 14 miles south of Safford. F. J. Hall is president.

YAVAPAI COUNTY

Arizona Smelting Company—The reorganization has been completed and active operation will begin April 1. Martin J. Heller will act as consulting engineer.

Hillside Consolidated—This property at Cherry includes four different claims, on which there are 6000 ft. of workings and two small mills of 25 tons capacity. The district is 15 miles from the railroad, and at present there are several small operations under way there. The deepest workings are 500 ft. The company has commenced sinking a 300-ft. shaft. The ores carry principally gold and some copper. M. M. Green is manager.

California

AMADOR COUNTY

Argonaut—This company will soon operate the Hamby mine four miles from Angels.

Burgess—This new camp, at an altitude of 10,000 ft., has considerable work going on by leasers during this winter.

INYO COUNTY

Buckeye—Machinery is now being taken into the mines for a hydroelectric installation and for a reduction plant. The shaft is now down 200 ft., and when equipment is installed, it is proposed to sink it to 1000 ft. The property is at Bishop. L. C. Davis is manager.

KERN COUNTY

In the Kernville district the Keyes mine is taking out rich ore. The Glen Olive will soon start up under charge of Benjamin Chavez. The Oujana company, owning the old Big Blue, is expected to commence operations soon.

Mammoth—Mr. Keating expects to put a new mill on this mine at Kernville.

MARIPOSA COUNTY

Trujillo—Operations will soon start in this mine, C. G. Lewis in charge.

MONO COUNTY

The Pittsburg-Liberty mine in the Masonic district will soon resume the treatment of tailings at the cyanide plant. The mill is crushing 20 tons of \$30 ore daily. The gasolene engine has reduced fuel expenses at mill by one-half. In the True Friend three shifts of men are working on the long tunnel. On the Serita leasers are at work.

RIVERSIDE COUNTY

Mohawk Herald—The company, E. M. MacDermott, manager, will soon erect a 10-stamp mill on the Anaconda mine, near Indio.

Colorado

BOULDER COUNTY

Logan—This property at Crisman has been sold to A. S. Cox. The mine has been a producer.

SAN JUAN DISTRICT

Camp Bird—The February returns show: Ore crushed, 6618 tons, yielding 9985 oz. bullion and 534 tons concentrates. The cash receipts were \$205,779, and the operating expenses, \$52,167, leaving a net balance of \$155,890.

Silver Ledge—The 200-ton mill, idle for several years, has resumed under management of Karl A. Knupfer. Electric power is used.

TELLER COUNTY

Granite—This company, which owns a group in the heart of the town of Victor, comprising the Granite, Gold Coin, Monument and Dillon, this month has shipped about 1000 tons of ore, yielding \$36 in gold to the ton. The mine and dumps are being worked by leasers.

Republic—This property, working the J. I. C. mine through the Rigi shaft, on Battle mountain, has a shoot of ore in the lower workings which carries ore that runs from 1½ to 4 oz. gold to the ton, and is shipping about two cars per week to the smelteries.

Old Gold—This mine, on Beacon hill, is shipping 10 cars of ore per month, that will yield 2 oz. gold to the ton.

El Paso-Gold King—This mine, under lease to Owen Roberts, is making daily shipments of ore yielding 1½ oz. gold to the ton.

Illinois

Ziegler—This colliery, owned by Joseph Leiter, of Chicago, the scene of prolonged labor troubles and finally closed, has been leased to a new company formed by local people. It is near Christopher, in Franklin county.

Indiana

GIBSON COUNTY

With continued good weather the oil-fields have been busy. Leases have blanketed almost the entire county and in order to hold them wells are being put down in considerable number. L. Sharer & Co. recently completed a good oil producer on the Kearns farm; the Rogers-Risch Company completed three wells—two gas and one oil; R. Lee Clark, of Lafayette, completed his third oil well on the Cate farm. All are 75-bbl. producers.

VIGO COUNTY

The A. & L. Coal and Clay Mining Company has incorporated, with office at Terre Haute, to mine coal, clays and other minerals; to own, lease and develop coal and clay lands, and to equip factories for the manufacture of clay products. The directors are Charles W. Abbott, Daniel E. Loudermilk and Robert H. Catlin.

SULLIVAN COUNTY

Fire has been raging in the Mammoth Vein mine, one mile north of Sullivan, owned by the Alliance Coal Mining Company. The fire was first discovered in the east entry on March 21. A chemical apparatus has been at work on the flames for a week and it is thought the fire will soon be under control. Over 200 men have been thrown out of employment.

Michigan

COPPER

Mohawk—No. 6 shaft is at the second level, and the crosscut from this point to cut the lode has been extended about 35 ft., over half the distance. Drifting from the first level, 210 ft. from surface, continues yielding a good grade of stamp rock which is being shipped direct to the mill.

Isle Royale—The "A" shaft, sinking to open the Baltic lode, is down about 950 ft., where the fifth level is being cut out. This shaft is sinking on the formation with small quantities of copper appearing, but nothing of a continuous or commercial nature. A drift toward the southwest has been extended for 400 ft. with the formation shattered.

North Lake—The company recently penetrated the No. 2 Adventure lode with its No. 7 drill hole, but the core taken from the formation at this point carried but little copper.

Franklin—This company has finished its first drill hole, which is searching for the No. 3 Hancock lode, without results, the drill apparently being in the footwall side or too far east. The drill has been moved.

New Baltic—No. 3 drill hole is down 750 ft. in an amygdaloid formation, capping the Baltic lode, and it is expected that this lode will be encountered within the next 100 ft. Another drilling outfit has gone into commission, and in all probability sufficient data will be secured to warrant the starting of a shaft during the summer.

South Lake—This company is operating two drilling outfits. No. 1 drill hole is down 1700 ft., and No. 2 hole 1350 feet.

Atlantic—Drifting is in progress from the 15th level to the north with copper in small quantities appearing. At the 25th level, drifts are being extended north and south with the same results. In the crosscut from the 16th level to the sandstone an encouraging formation was cut 700 ft. from the shaft. This lode is now being opened, and its extension determined.

Minnesota

Nassau—This iron property, near Hibbing, has been acquired by the Jones & Laughlin company.

Montana

BUTTE DISTRICT

Amalgamated—At the Mountain View mine sinking on the air shaft was begun two weeks ago. The shaft is down 1200 ft. and will be sunk to 1400 ft. An air raise has been started from the 100-ft. level to the surface, a distance of 350 ft., and about 200 ft. of the raise has been completed. This has no connection with the air shaft. On the 1800-ft. level the crosscut to the Pennsylvania mine is now within 80 ft. of the Pennsylvania workings. By means of this crosscut some of the Mount View ore will be worked through the Pennsylvania shaft and the ventilation of both mines improved. At the Badger State on the 1300-ft. level, the vein has been cut 300 ft. south of the shaft, and drifting is being done east and west while the crosscut is being continued south. The shaft is down 1700 ft. and will be continued to 1800 ft., where a station will be cut. Through the Badger State workings a drift is being run on the old Speculator lode on the 1200-ft. level, which is found to run high in zinc and low in copper. The new boiler plant at the Badger State has been completed and is

now in operation. At the Pennsylvania 1300 tons are being hoisted daily. The new 350-gal. electric pump on the 1800-ft. level is giving satisfaction. Owing to the fact that the pump can more than take care of the mine water and that when run at all it must be run at full capacity, the pump is run for two hours and then shut down that length of time, thus averaging one-half its capacity. At the Leonard the No. 1 shaft is being retimbered and will be used to lower timber and supplies.

GRANITE COUNTY

Crescent—Manager Hand is expected to return shortly, when the operations will be resumed. The mine has been idle since October.

New York & Montana—The management has decided to run a 300-ft. tunnel on the property at Colomia, three miles north of Garnet. Some years ago a shaft was sunk 400 ft., but operations by that method proved too expensive and it is thought the tunnel will lessen considerably the mining costs. A 10-stamp mill and concentrator are on the property.

Granite-Bimetallic—At a recent meeting of the directors the following officers were elected: Charles D. McLure, president; August B. Ewing, first vice-president; Edward S. Orr, second vice-president; L. N. Rumsey, secretary; and G. T. Tansy, treasurer.

MADISON COUNTY

Conrey Placer Company—The dredge recently ordered will be ready for operation Nov. 1. It will have a capacity of 300,000 cu.yd. of gravel per month. The hull will be 150 ft. long, 58 ft. wide, and 13 ft. deep. The dredge will be operated by electricity and will require 1050 h.p. The capacity will equal that of the present three combined, and will thus double the output.

Nevada

ESMERALDA COUNTY

Goldfield Consolidated—In spite of the immense production necessary to keep the big mill in operation the ore reserves are increasing ahead of the extraction. In the Combination mine large stopes are being worked on both the Combination and January veins. They are to be carried through to the surface where they will terminate in "glory holes." Work is in progress around the caved Hampton stope, the purpose being to make it thoroughly accessible whenever it is desired to draw out the ore.

Merger—Six leases are now being worked on Merger estate, and two new hoists have been put in operation.

Combination Fraction—Reports of a strong body of promising ore, breaking between \$30 and \$40 per ton, on the 500-ft. level and another development just above the 380-ft. level resulted in a sudden jump in the stock. According to the

new manager, Charles Wilkinson, the Nevada-Goldfield mill will again be in operation on Combination ores as soon as sufficient ore is in sight to run continuously.

Commonwealth—A lateral from the old company tunnel is being driven to tap a 3-ft. oreshoot recently exposed by a winze from the level above.

Merger Mines Company—The gasolene hoist now in operation is to be replaced by a 50-h.p. electric hoist, the old gasolene engine to be used for raising water.

Pittsburg-Silver Peak—The glory hole is assuming enormous proportions, and large lenses of ore are being opened near the surface. The ore is by no means high grade, but the method of breaking the rock and getting it to the mill is so economical that there is good profit in handling the large tonnage.

LINCOLN COUNTY

Consolidated Pioche—Extensive tests are being made in the East on samples of the large tonnage of gold-silver-zinc ore developed. It is planned to build, immediately, the first unit of a reduction plant to treat the ore after the manner determined by these experiments.

Prince Consolidated—Development work steadily increases the tonnage already blocked out and the company is now waiting for the completion of the work of reconstructing the Salt Lake Route's line through Meadow Valley wash.

NYE COUNTY

The estimated production during week ended March 19 is: Tonopah, 3450; Belmont, 750; Montana-Tonopah, 589; Mac-Namara, 200; West End, 160; Tonopah Extension, 840; Midway, 80; total 6069 tons valued at \$151,725.

Tonopah—A new shaft has been started on the Sand Grass claim at the extreme western end of the property. It is 2000 ft. west of the Red Plume, in the center of a large acreage of virgin ground, and is already 165 ft. deep. Lateral work will begin at the 400-ft. level. Mill report for the week shows 3275 tons of rock averaging \$18 crushed. Bullion shipment consisted of 54 bars of bullion valued at \$44,550, and 13 tons of concentrates worth \$13,950, making a total recovery of \$58,500. An average extraction of 92 per cent. was recorded.

Montana-Tonopah—A strong vein carrying good values throughout has been encountered on the 615-ft. level, supposedly a continuation of the Martha vein. The semi-monthly clean up resulted in 25 bars of bullion.

Belmont—The report of Superintendent Bradshaw for February shows 2525 tons shipped to the smelter with net returns averaging \$21.02. The development of the Belmont vein on the 1100-ft. level shows the continuation of a good grade of ore.

Round Mountain—A new 50-h.p. electric hoist has been installed to prosecute development work in new territory. J. F. Thorne, the new superintendent, is sending a little more than 100 tons daily through the mill. Bullion returns for February show an output of \$36,000. The directors declared the eighth quarterly dividend of 4c. per share, Feb. 12.

Bullfrog Pioneer—The Mayflower 100-ton mill has been leased and will be immediately put in operation reducing Pioneer low-grade ore. Daily shipments are being made of 15 to 20 tons of high-grade ore.

Keane Wonder—The uncovering of an entirely new orebody of high-grade rock on the lower tunnel level is reported.

Pioneer Oil Company—A complete equipment for drilling to depth has been shipped to Indiana Springs, 70 miles south of Rhyolite by Manager McFarland.

Nevada Ore Treating Company—The custom mill at Beatty has begun operation on a shipment of \$40 ore from Pioneer. The company has established a rate of \$6 as a treatment charge for ores up to \$50.

War Eagle—The mill at Round Mountain is treating 1500 tons of Jumping Jack ore.

WASHOE COUNTY

Western Smelters Corporation—The company has commenced work on a 250-ton smelting plant near Reno. W. E. Patterson is manager.

New Mexico

DONA ANA COUNTY

Bennett-Stephenson—This company in the Organ mountains, having settled its legal difficulties, is again operating. The 400-ft. shaft will be sunk to 600 ft. The ore is lead, with copper and silver and some wulfenite. A 200-ton mill is on the property. J. J. McCullough, Las Cruces, is in charge.

Memphis—This property, two miles north of the Bennett-Stephenson, is shipping copper ores from surface development. D. H. Donworthy is manager.

SIERRA COUNTY

Bimetallic—This Deming (N. M.) company, Alfred Strum, president, is developing a gold and silver property near Kingston.

Sigma—The new shaft on the Wicks vein, near Hillsboro, is down 300 ft., and will continue to 500. A. G. Viegis is manager, and Fred Phillips, superintendent.

North Dakota

The surface equipment of the Lloyd lignite mine at Burlington, one of the larger mines of the State, has been burned. The owners propose to put up new buildings and machinery at once.

Ohio

Sunday Creek mine No. 209, near Athens, has been sealed in consequence of a serious fire which was started by a blown-out shot.

Pennsylvania

ANTHRACITE COAL

Lehigh Valley Coal Company—The Mineral Springs breaker has been burned; loss \$250,000. Over 1000 men are out of employment.

Temple Iron Company—At the annual meeting in Reading, Penn., the following directors were chosen: George F. Baer, Albert Broden, Thomas P. Fowler, J. S. Harris, W. J. Richards, F. C. Smink, E. B. Thomas, M. H. Truesdale, F. D. Underwood. The board elected George F. Baer president; F. Law, vice-president and treasurer.

BITUMINOUS COAL

Options on 3500 acres of coal land in the Pendleton district, Cambria county, have been secured by Peter J. Little, of Ebensburg, who, it is understood, represents J. H. Weaver & Co., of Philadelphia, who operate two mines in the county.

A syndicate of Philadelphia people has taken an option on a large tract of land in Allegheny township in Westmoreland county. The land carries the Freeport vein, and lies along the Allegheny and Kiskiminetas rivers. The option is at \$50 per acre. Diamond drills have been put at work on the property.

BUCKS COUNTY

Interest has been recently revived in the mineral belts on the old Logan grant in Milford and Buckingham townships. Lead ore was found there and mined in a small way many years ago. Now it is claimed that zinc ore has been found in Milford, and the owners propose to make further explorations.

South Dakota

Homestake—The company has resumed its dividends at the old rate of 50c. a share monthly.

Utah

BEAVER COUNTY

Majestic—A shipment from the ore recently encountered in the Hoosier Boy claims is being prepared for the market. It is proposed to build a tramway from the Harrington-Hickory mine to the railroad.

Red Warrior—Work is being continued on the orebody recently opened on the 300-ft. level. Shipping ore taken out in development has been stored on the dump. The company is now hauling this ore to Milford.

BOX ELDER COUNTY

Homber—This company, which owns a graphite deposit near Perry, has recently

become interested in the manufacture of mineral paint under the name of the Homber Mining and Manufacturing Company, and the work of constructing a mill has been begun at Ogden. The company has acquired ground near Richfield from which red oxide of iron is obtained, also some ochre deposits in San Pete county. It is expected that the initial cost of the plant will be in the neighborhood of \$15,000.

JUAB COUNTY

Tintic ore shipments in carloads for the week ended March 18 were as follows: Victoria, 7; Grand Central, 5; Swansea, 1; Beck Tunnel, 3; Colorado, 16; Sioux Consolidated, 19; Iron Blossom, 19; Dragon Iron, 22; Scranton, 6; Gemini, 6; East Tintic Development, 2; Chief Consolidated, 6; Eagle & Blue Bell, 6; Centennial-Eureka, 38; Ophongo, 2; Gold Chain, 2; total, 160 cars.

Utah—This property at Fish Springs has marketed another carload of silver-lead ore. The smeltery returns on 38 tons were reported to have been \$3289.

Lower Mammoth—At a recent meeting of the directors it was announced that ore shipments should cover the cost of development, and would obviate the necessity for further assessments. The ore-bodies between the 1700- and 1800-ft. levels are larger and better than expected.

Iron Blossom—Work is being done on the 500 level of the No. 3 shaft. The drift is 200 ft. east of the shaft, and has encountered a new fissure. The company is drifting on the 1400 level of the far south shaft. It is said that shipping ore is being mined from a raise on the 500 level. This ore is silicious and carries more gold than usual.

East Tintic Development—Two carloads of silver-lead ore have been shipped. Four feet of ore is reported in the winze below the 235-ft. level.

East Tintic-Gold King—At the annual meeting of the stockholders, it was decided to make the stock of the company assessable. Development work will be started soon.

Grand Central—A dividend of 6c. a share was declared by the Grand Central, payable March 25. The distribution amounts to \$36,000. The mine is in good condition.

Victoria—This company has announced a dividend of 4c. a share payable on March 25. The dividend amounts to \$10,000. The property is in good condition.

Chief Consolidated—An increased force of miners has been put to work on ore. During February, the company shipped 10 carloads of ore that netted better than \$1000 a car. Up to March 14 the ore shipments were 12 carloads. The greater part of the ore is coming from the 1400- and 1600-ft. levels. The grade of

the ore has been improving. The shaft is now below the 1700-ft. level, and sinking is in progress. This work is slow on account of the hoisting plants being taxed almost to its capacity in raising ore. Drifting will be started on the 1800-ft. level. The new hoisting plant which has been ordered is expected to arrive in June. Practically all of the Eureka City company's stock has been exchanged for Chief Consolidated.

SUMMIT COUNTY

Owing to the gradual breaking up of winter, with no sudden changes in temperature, the Park City roads are better than they were at this time last year. This will contribute to more satisfactory conditions for hauling ore during the spring and summer.

American Flag—Ore has been opened by a crosscut on the 400-ft. level. This is thought to be the vein from which ore was produced on the tunnel level above.

New York Bonanza—The drift southeast of the shaft on the 1000 level is following a fissure which carries about 10 in. of mineralized vein matter, showing galena.

Little Bell Consolidated—The company paid its second dividend, amounting to \$15,000, March 22. A report to stockholders shows that during the quarter ended Feb. 28, 1910, the company marketed 1428 dry tons of ore which carried 21.18 per cent. lead, 75.66 oz. silver, 0.0474 oz. gold, and 2.28 per cent. copper. The net smeltery returns on this ore were \$46.30 a ton, or a total of \$66,113. The earnings for the quarter amounted to \$40,063 which, after paying dividend No. 2, added \$25,053 to the company's surplus.

Virginia

Arrangements are reported complete for the consolidation of all the mining interests in the Black Mountain district, southwestern Virginia, under the organization of the Dominion Coal Company, an Ohio corporation. The companies to be absorbed are the Black Mountain, the Derby, the Imboden, the Monarch, the St. Charles and the Virginia-Lee coal companies.

West Virginia

Buffalo Colliery Company—A central power plant is being erected, which will furnish power to the Buffalo colliery and also to the Hatfield mine, which was recently bought by the company. A transmission line to Hatfield is being put up. The company has also let a contract for a new coal-washing plant at Buffalo, Mercer county.

Wisconsin

ZINC-LEAD DISTRICT

Wisconsin Zinc Company—This company has subleased the Grant County,

adjoining the Empire mine, on the north; the new shaft on the Longhenry land has opened up a big body of heavy sheet ore.

Gogebic—A new shaft will be sunk on the Seitz land, east of the Klar-Piquette, where recent drilling indicated rich ground.

Kohinoor Blende—The 75-ton mill is completed, and operations will be commenced April 1.

Dickson-Oettiker—A small milling plant has been erected, east of the St. Rose, and mining resumed.

Peaceful Valley—A 25-ton mill has been installed on the Henry Kettler land, north of the Best.

Wallace—This Highland company has purchased the 100-ton mill of the Appelt-Galena.

Wyoming

CARBON COUNTY

Rambler Copper and Platinum Company—This company has been shipping high-grade copper ore since August, 1909, and is now installing a 50-ton unit for the concentration of the platinum ores and of the lower-grade copper ores. It is claimed that there are 15,000 tons of ore containing platinum blocked out. The company is experimenting on a method for the treatment of this ore. W. J. Sherwood is manager and Robert A. Marr is engineer and metallurgist.

Canada

BRITISH COLUMBIA

Crows Nest Pass Coal Company—At the annual meeting held in Toronto, March 11, a financial statement was presented showing net profits of \$145,029, which, added to the balance at credit on Dec. 31, 1908, gave a balance at profit and loss of \$156,025. The liabilities included bills payable amounting to \$1,221,134. The output of the year was 899,045 tons of coal, and 250,254 tons of coke. President Elias Rogers stated that since the first of this year, the tonnage had greatly increased. In January, the output was 99,489 tons, compared with 58,718 tons in January, 1909, and in February, 95,977 tons, as against 65,500 tons last year. During the year a total amount of \$215,839 had been expended on improvements. Considerable dissatisfaction was expressed at the small proportion of profit made on the output, which was stated at 16c. per ton.

ONTARIO—COBALT

The shipments from Cobalt for the week ended March 18 are as follows: La Rose, 238,974 pounds; McKinley-Daragh, 150,561; Buffalo, 124,500; Nipissing, 65,381; Crown Reserve, 61,110; Hudson Bay, 61,330; total, 701,856 pounds.

Orizaba—This property in the Maple Mountain district is looking better, and another 100-ft. shaft will be sunk.

Silver Bar—Some of the buildings were destroyed by fire recently.

Silver Lode—Operations are to be resumed, and the shaft will be sunk.

Silver Cliff—The mill is completed and is waiting for power. There are 18,000 tons of mill rock on the dump and in the stopes.

Mexico

BAJA CALIFORNIA

Beryl—This American company has given an option on its gold mines and milling plant in the San Andres district to English interests. The mines are being examined. The ore in sight is estimated at 75,000 tons.

Julius Caesar—Patrick Burns, of British Columbia, has bought these mines in Baja California.

CHIHUAHUA

Virgen—This gold property in the Placere de Guadalupe section, east of Chihuahua, has been purchased by Luis Terrazas, Jr., of Chihuahua, who will extensively exploit it and install new machinery.

Sierra—This Cole-Ryan company operating at Ocampo is planning to build a hydroelectric plant.

Orient—The mining properties owned by the Stillwell interest and the Kansas City, Mexico & Orient Railway are now in charge of R. H. Burroughs, formerly of Guanajuato, and it is reported that considerable work necessitating machinery purchases is to be started. Mr. Burroughs has headquarters at Chihuahua.

Santa Elena—This lead property in the Terrazas camp north of Chihuahua is shipping ten carloads weekly to El Paso. Harbottle & McKenzie are the operators.

Santa Eulalia Exploration Company—The properties are undergoing examination by engineers of the Exploration Company.

Mary M.—This company is increasing its operations in the vicinity of Alamos, Son. T. C. Woodworth is the manager.

Ronquilla—The Arizona-Parral company is carrying on a large amount of work at this Parral mine. The new power and milling plants are in operation.

Parral-Chihuahua Company—This company is developing two properties at Parral, the San Eduweges and San Miguel, and machinery will be installed at both, shortly.

Parral Consolidated—Electrical sinking pumps are being installed at the Prieta mine, and as soon as the lower workings are unwatered the new mill will be put in operation again. R. L. Wilson is in charge.

La Republica—This company is operating a high-grade silver mine near the western border of the State, making an extraction of over 90 per cent. by concentration and cyanidation. The property

has to contend with over 1000 gal. of water per minute, and all operations are handled with sectionalized machinery, necessitated by transportation conditions. New motor-driven Aldrich triplex pumps are now being installed. E. H. Webster, formerly of the Dolores mine, is manager, and J. Gordon Hardy, of El Paso, consulting engineer. The company treated for the quarter ending Jan. 1, 3067 tons, which yielded 198,410 pesos, at an expense of 108,271 pesos.

COAHUILA

At Sierra Mojada the American Smelting and Refining Company is operating 4 mines with an approximate monthly shipping output of 3000 tons of lead-silver ore. La Constancia mine, an independent operation, is shipping 200 tons monthly to Torreon. This company will begin prospecting with diamond drills.

JALISCO

The Chapala company will extend its Etzatlan transmission line to the Ameca district. Power is being offered in that district at 125 pesos per h.p. a year.

Amajac—Machinery for remodeling the reduction works in the Hostotipaquillo district has been shipped. The new plant will start with a capacity of 75 tons daily, and custom work will be done. Much ore is available in the company's Refugio, Tres Estrellas and Las Animas mines.

Magistral-Ameca—Stopping is in progress preparatory to milling. The 100-ton plant will be completed May 1. The Elmore flotation process will be used in the treatment of copper ores for the first time in Mexico.

MEXICO

Esperanza—The company reports the return for February as follows: Mill ran 24 days and crushed 13,863 dry tons of ore; estimated realizable value of bullion produced, \$180,061; concentrates, \$8878; total, \$188,939; working expenses, \$98,428; estimated profit, £17,086.

SONORA

El Tigre—During 1909 this company reports an exportation of 4150 tons of first-grade ore and milled product, for which \$1,087,275 was paid. Operating expenses approximated \$500,675, including betterments, which leaves its earnings \$586,600. It is claimed that when the milling capacity is doubled, the visible ore supply is sufficient for five years.

Sonora Central—The San Domingo mine, near Alamos, is being steadily worked and good ore has been developed, which justifies the erection of a reduction plant.

La Libertad—This gold property near San Antonio de la Huerta is being developed by H. L. Miller.

Durazno—The operators of this mine, east of Alamos, shipped 165 oz. gold bullion.

Zambona—The mill is treating the tailings from previous operations at the Minas Nuevas with satisfactory returns.

Monarca—The holdings of this company, near Carbo, are being exploited with core drills.

Essex—Fifteen men are employed in opening a lime and porophy contact deposit in the Sierra Azul mountains, east of Imuris.

Los Animas—The company has recently expended \$25,000 for machinery.

Greene-Cananea—The erection of orebins, sufficient in capacity to receive the output of the Sierra de Cobre and Elisa mines, has been started at the entrance to the 3000-ft. Elisa tunnel. The plans specify arrangement for an addition to meet the requirements of the Henrietta mine, when the tunnel has been extended that far. Three shafts are being sunk on the Sierra de Cobre, and the development work at this point is more exhaustive than at any other mine. The quantity of first-grade ore considerably exceeds that requiring concentration. An electric hoist of medium size is being placed at Oversight No. 11 shaft, and a much larger one has been ordered for the main shaft at the Cananea-Duluth. All reclassifying work at concentrator No. 2 will be finished during April, and every unit will be put in operation.

TEPIC

Santa Maria del Oro—John McSorley, representing California capitalists, is negotiating for the principal mines of the Santa Maria del Oro district. He will also acquire properties in the old Compostela district.

VERACRUZ

Oil Fields of Mexico—This oil company, Percy N. Furber, president, and Arthur C. Payne, manager, has listed its stock on the New York curb market. The company has a government concession to oil land in the gulf field and has been operating for some time.

Africa

WEST AFRICA

Gold returns for Ashanti and the Gold Coast in February are 16,976 oz. For the two months ended Feb. 28 the total was 44,220 oz. bullion in 1909, and 34,333 oz. in 1910; a decrease of 9887 oz. The bullion reported this year was equal to \$677,290, or 31,799 oz. fine gold.

Asia

INDIA—MYSORE

Kolar Goldfield—Gold production in February is reported at 45,464 oz., being 1084 oz. less than in January. For the two months ended Feb. 28, the total was 88,929 oz. bullion in 1909, and 92,012 oz. in 1910; an increase of 3083 oz. The bullion reported this year was equal to \$1,811,600, or 82,811 oz. fine gold.

THE MARKETS

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

Coal Trade Review

New York, March 30—The bituminous-coal trade in the East is in fair condition. Business is steady but there is no marked improvement in conditions. There is, however, less trouble about car supply and coal is moving more freely than for some time.

The anthracite trade has had a little spurt of activity, owing to the coming of the usual April discount on list prices at tidewater.

In the West the main question is as to the probability of a strike. Opinion generally is inclined to the view that there will be no suspension of mining, or at least only a very short one. Moreover, there are accumulated stocks of coal at many points sufficient to tide over a stoppage of moderate duration.

The Wage Scale Agreement—At Cincinnati on March 28, the scale committee presented to the Miners' convention the proposition of the operators, which was as follows:

1—The present agreement to be continued until March 31, 1911, with the exception of the mining prices.

2—In western Pennsylvania thin vein, in the Hocking—the basing district of Ohio—and in the block and bituminous districts of Indiana, the price for mining to be increased 5c. per ton on 1½-in. screened coal for pick mining, and 4c. for machine mining; in Indiana districts where mine-run coal is the basis the increase will be 4c. for pick and 3c. for machine mining.

3—The inside day-wage scale to be advanced 5.55 per cent. with the conditions of the Columbus scale of 1898. All narrow work, deadwork, room-turning and outside day labor to be paid an advance proportionate to the pick-mining rate.

4—Local differences to be referred for adjustment to the various districts affected, with the agreement that in such adjustment "there shall be no additional cost to the operators in mining coal during the life of this agreement."

After a short debate, the miners voted to reject this proposition, but without substituting anything in its place. The joint scale committee thereupon resumed its conference, but no result had been reached up to the present writing.

The operators in the Southwestern Interstate Association, including Missouri, Kansas, Arkansas and Oklahoma, have refused to grant the demand of the min-

ers for an advance of 10c. per ton for pick mining and payment on a run-of-mine basis. They have issued a statement saying that an advance is impossible, in view of the fact that they have to compete with crude oil as a fuel, as well as with coal from other States.

COAL TRAFFIC NOTES

Coastwise shipments of coal by water from chief Atlantic ports, month of January, long tons:

	Anthracite.	Bitum.	Total.	PerCt.
New York....	1,527,876	913,754	2,441,630	65.8
Philadelphia	169,668	357,229	526,897	14.2
Baltimore....	19,555	285,289	304,844	8.2
Newp't News	.....	244,106	244,106	6.6
Norfolk.....	.....	192,142	192,142	5.2
Total.....	1,717,039	1,992,520	3,709,559	100.0
Total, 1909.	1,398,362	1,835,696	3,234,058	.....

Total increase this year 457,501 tons, or 32.7 per cent. New York includes all the harbor shipping points.

Bituminous coal and coke tonnage of leading railroads in Pennsylvania and West Virginia in January, short tons:

	Bituminous.	Coke.	Total.
Pennsylvania.....	3,624,729	1,413,157	5,037,886
Balt. & Ohio.....	2,139,323	403,048	2,542,371
Buff., Roch. & Pitts.	613,947	59,750	673,697
Buff. & Susqueh'na	106,150	28,810	134,960
Penn. lines, N. Y. C.	862,175	6,798	868,973
Pitts. & L. Erie.....	934,202	643,437	1,577,639
Pitts., Shawmut&N.	109,228	2,808	112,036
Norfolk & Western.	1,388,939	273,078	1,662,017
Ches. & Ohio.....	1,267,117	44,624	1,311,741
Virginian.....	.....	.....	.....
Total.....	11,045,810	2,875,510	13,921,320
Total, 1909.....	8,573,784	1,895,467	10,469,251

Total increase this year, 3,452,071 tons, or 33 per cent. Anthracite tonnage of Pennsylvania and Baltimore & Ohio is not included.

Coal tonnage of railroads in Ohio Coal Traffic Association, month of January, short tons:

	1909.	1910.	Changes.
Hocking Valley	244,945	412,472	I. 167,527
Toledo & Ohio Cent	96,765	149,572	I. 52,807
Baltimore & Ohio ...	100,426	197,272	I. 96,846
Wheeling & L. Erie	212,991	325,481	I. 112,490
Cleve., Lorain & Wh.	155,138	253,252	I. 98,114
Zanesville & Western	105,261	128,862	I. 23,601
Toledo Div., Pen. Co.	162,820	219,907	I. 57,087
L. Erie, Alliance & Wh.	96,351	105,290	I. 8,939
Marietta, Col. & Clew.	3,002	13,095	I. 10,093
Wabash-Pitts. Term.	.....	4,405	I. 4,405
Total.....	1,177,699	1,809,608	I. 631,909

Total increase this year, 53.6 per cent. Only the Ohio lines of the Baltimore & Ohio are included; the main line tonnage is given elsewhere.

Anthracite tonnage of the Baltimore & Ohio, main line, in January was 90,099 tons in 1909, and 106,598 in 1910; increase, 16,499 tons.

Coal receipts at St. Louis, year ended Dec. 31, were 6,890,286 short tons in 1908, and 7,150,340 in 1909; increase, 260,054 tons.

Coal shipments reported by South-

western Interstate Coal Operators' Association, year ended Dec. 31, short tons:

	1908.	1909.	Changes.
Missouri.....	2,370,022	2,574,873	I. 204,851
Kansas.....	5,122,509	5,779,397	I. 656,888
Arkansas.....	1,948,911	2,090,540	I. 141,629
Oklahoma.....	2,728,292	2,554,566	D. 173,726
Total.....	12,169,734	12,999,376	I. 829,642

The total increase in shipments in 1909 was 6.8 per cent.

New York ANTHRACITE

March 30—A week of almost summer weather has not been favorable to the market. On the other hand, the coming of the April discounts has caused some activity in orders from dealers. Quite a number of collieries closed down from Thursday to Tuesday of this week.

On Friday of this week, April 1, the schedule prices for prepared sizes are reduced to \$4.25 for lump and \$4.50 for egg, stove and chestnut, all f.o.b. New York harbor. Quotations for steam sizes are unchanged and are f.o.b. New York harbor points, according to grade: Pea, \$3@3.25; buckwheat, \$2.35@2.50; No. 2 buckwheat or rice, \$1.75@2; barley, \$1.35@1.50. The lower prices are generally for washery coal.

BITUMINOUS

Contract making continues slowly, and there are a larger number not yet closed than is usual at this date. As heretofore noted, the tendency this year is to take the cheaper grades of coal.

The Government contract for coal for Panama has been let for Pocahontas coal at \$2.63@2.75 per ton, f.o.b. Norfolk or Newport News. The ocean freight will run from \$1.43 up to \$1.60 per ton.

Spot business is quiet and sales are a little disappointing. Prices continue low; the best grades of steam coal being about \$2.75 per ton, but lower grades are sold down to \$2.50 and even \$2.40, f.o.b. New York harbor. Transportation is good and car supply is improving. All-rail trade is reported fair.

The coastwise-vessel market is still a little unsettled, but vessels are plentiful and rates are inclined to be lower.

There is some talk about the probability of a strike in the West. Coal men here do not think a strike would affect this market; and many think that the Western operators would be quite willing to see a short stoppage.

Birmingham

March 29—Coal operations in Alabama continue at the top notch. All operators

in this section of the country are up with deliveries. Additional orders for coal are in sight and there is promise of steady operation through the summer. Efforts are being made to bring in more labor for the mines. The outward movement of coal from Alabama is steady. The coke demand is keeping up with the supply and the producers are losing no time at the ovens, all being kept in full operation.

Chicago

March 28—Despite the unfavorable outlook on the labor situation, the average consumer of steam coal continues to be optimistic regarding the future, and in consequence sales of steam coals are not heavy in general. Prices have sagged a little from last week's record; even screenings, for several weeks very firm at abnormal figures because of large demand and small supply, have moved down slightly. The feeling among consumers seems to be one of confidence in the future supply. Owing to the very warm weather and the approach of April with its discounts on anthracite, there is hardly any trade in domestic coals.

Illinois and Indiana lump brings \$2.20 @2.40; run-of-mine, \$1.90@2.10; and screenings \$1.90@2. Smokeless, the leading coal from east of Indiana, holds to \$3.55@3.65 for lump, and run-of-mine brings \$2.90@3.05. The supply of smokeless continues large, making frequent depression of prices, as shipments arrive in waves. Hocking is steady, in good demand and well regulated supply, at \$3.15 per ton.

Cleveland

March 28—Loading for Lake shipment continues, and a number of boats will be ready to start as soon as navigation is open. Not many season contracts have been closed so far. Local business is quiet, as most people think there will be no strike. There is plenty of coal to be had now.

Quotations for Middle district coal, Cleveland delivery, are \$2 for 1¼-in.; \$1.85 for ¾-in.; \$1.75 for run-of-mine, and \$1.65 for slack. No. 8 district, \$2.20 for 1¼-in.; \$2 for ¾-in.; \$1.90 for run-of-mine, and \$1.85 for slack. Cambridge district about the same as No. 8. Youghiogeny is quoted at \$2.40 for 1¼-in., and \$2.15 for run-of-mine.

Indianapolis

March 28—The action of the miners in convention to allow district agreements, seemed to do away with the possibility of a general strike, but the move by the joint conference late Saturday is thought to be even better than the convention's action, inasmuch as it now appears as though an agreement between all parties concerned will be reached. Much praise is being given President Lewis for having labored on patiently in-

stead of rushing headlong into a general and disastrous strike.

Pittsburg

March 29—The convention machinery in Cincinnati is still in operation, but has not produced a settlement. The prospects have increased that there will be a suspension of mining, and it is more openly admitted that the trade needs a suspension to improve market conditions.

There has been only a moderate demand for coal in the past week, less than would be expected with a suspension imminent. There have been no further advances in prices, while slack has actually declined, fully 10c., and is quotable at \$1.05@1.10, although late last week a few sales were made up to \$1.15. Two contracts have been made at 80c., for April, May and June shipment, with the usual strike clause, and the market is quotable at 75@80c. for such delivery. Mine-run and nut are quotable at \$1.15 @1.25, the higher price being usually asked, but the lower price possible with good buyers; ¾-in. is quotable at \$1.25 @1.35, with \$1.40 for 1¼-in. domestic.

Connellsville Coke—The tone of the market has improved, there being better inquiry, with some fair business put through. Two contracts with furnaces have been made, involving a total of about 17,000 tons monthly for second half, at about \$2.25, ovens, for good grades, and \$2.25 or higher is being asked for second half. A sale of 1000 tons of prompt furnace is reported at \$2, and the market remains quotable at \$1.90@2 for good grades. Foundry coke is nominally about \$2.75@2.85 at oven.

The *Courier* reports production in the Connellsville and lower Connellsville region in the week ended March 19 at 462,320 tons; shipments at 4286 cars to Pittsburg, 8285 cars to points west of Pittsburg and 865 cars to points east of Connellsville, a total of 13,436 cars.

St. Louis

March 28—Strange as it may seem, the market has been very slow all week and prices have eased off considerably. This was altogether unexpected and seems most peculiar in the face of a strike. The only reason which can be assigned for the break is that the railroads are manipulating the market in order to buy cheap coal.

No matter what is done in Cincinnati it will not affect the Illinois field, as the Illinois operators are not represented. Even should an agreement be reached the Illinois fields would be practically shut down for several months, owing to the new stringent Illinois mining law which goes into effect April 1. This law will compel operators to make so many improvements in their mines before they can resume operations that it will take considerable time to fix them up.

Prices are as follows:

Standard:	F.o.b. Mine.	F.o.b. St. Louis.
6-in. lump.....	1.70	2.22
2-in. lump.....	1.60	2.12
Mine-run.....	1.50	1.82
2-in. nut.....	1.40	1.92
2-in. screenings.....	1.10	1.62
Pea and slack.....	0.80	1.32
Staunton, Mt. Olive & Springfield:		
6-in. lump.....	1.75	2.27
3-in. lump.....	1.65	2.17
Mine-run.....	1.30	1.82
2-in. nut.....	1.40	1.92
2-in. screenings.....	1.25	1.77
Cartersville:		
6-in. lump or egg.....	1.60	1.27
3-in. nut.....	1.60	2.27
Mine-run.....	1.25	1.92
1½-in. screenings.....	1.10	1.77
Franklin County:		
6-in. lump or egg.....	1.75	2.42
3-in. nut.....	1.70	2.37
2-in. nut.....	1.50	2.17
1½-in. screenings.....	1.20	1.87
Trenton:		
6-in. lump.....	2.25	2.77
6-in. egg.....	2.25	2.77
3-in. nut.....	1.75	2.27
Pennsylvania Anthracite:		
Nut, stove and egg.....		6.95
Grate.....		6.70
Arkansas Anthracite:		
Egg or grate.....	3.35	5.35
Coke:		
Connellsville foundry.....	2.50	5.30
Gas house.....		4.40
Smithing coal.....	1.65	4.15

Screenings and fine coal are the only sorts which have held their own.

FOREIGN COAL TRADE

Bunker Coal at United States Ports—Coal furnished to steamships in foreign trade at United States ports, month of January, long tons:

	1909.	1910.	Changes.
Coast ports.....	425,887	456,430	I. 30,598
Great Lakes.....	2,591	1,031	D. 1,560
Total.....	428,428	457,461	I. 29,033

Adding the exports, heretofore reported, the total coal sold for consumption outside of the United States was 1,184,713 tons this year.

Transvaal Coal—The coal mined in the Transvaal for the year ended Dec. 31 was 4,974,304 tons, of which 1,348,779 tons, or 27.1 per cent., were sorted or screened out as waste.

French Coal Trade—Imports and exports of fuel in France, year ended Dec. 31, metric tons:

	Imports.	Exports.	Excess.
Coal.....	15,426,030	1,132,528	Imp. 14,293,502
Coke.....	1,926,166	182,792	Imp. 1,743,374
Briquets.....	1,028,684	181,388	Imp. 847,296
Total.....	18,380,880	1,496,708	Imp. 16,884,172
Total, 1909.....	17,564,483	1,365,817	Imp. 16,198,666

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, Wales, report prices as follows on March 19; Best Welsh steam, \$4.08; seconds, \$3.96; thirds, \$3.84; dry coals, \$3.90; best Monmouthshire, \$3.60; seconds, \$3.48; best steam smalls, \$2.40; seconds, \$2.16. This is a general drop of 6c. a ton. All prices are per long ton f.o.b. shipping port, less 2½ per cent discount.

IRON TRADE REVIEW

New York, March 30—Recovery in the iron and steel markets is slow, and buyers do not seem to be in any hurry. They prefer to hold the waiting position they have occupied since December. There is a considerable volume of business to be done, but the closing of contracts is slow.

In pig iron business has been mostly of a small order both in the West and the East. It is apparently the belief of buyers that they can do better by waiting. In Eastern territory the market for foundry iron has been disturbed by offers of Alabama iron at low rates, down to \$12.50, Birmingham, having been named for No. 2 foundry. Some business is reported in the Buffalo district, which has gone chiefly to local furnaces. Sellers are inclined to hold back on second-half business.

In finished material some structural contracts are going, but the fabricating companies are still taking business at low rates. The Jones & Laughlin Steel Company has let contracts for two large ore-carriers on the Lakes, which will require a quantity of plates and shapes. Trolley rails are still in demand, but no large orders for standard sections are reported. Jobbers report a good trade in bars and small building material.

Great Northern Iron Ore Properties—The report of the trustees for the year 1909 shows that payments were \$1,500,000 dividends to certificate holders and \$77,094 expenses; total, \$1,577,094. Receipts from dividends, etc., were \$1,560,000, leaving a deficit of \$17,094. Balance brought forward from 1908 was \$256,073, leaving a surplus on hand Dec. 31 of \$238,979. Ore shipments from the properties were 3,016,619 tons, an increase of 1,547,694 over the preceding year.

Baltimore

March 28—Imports for the week included 594 tons ferromanganese from Rotterdam; 4821 tons iron pyrites from Huelva, Spain; 21,865 tons iron ore from Cuba.

Birmingham

March 28—No interruption is being allowed in the pig-iron make in the Southern territory and while there is some complaint still to be heard as to the lagging market, there is no iron going to the yards that should give the least alarm. Inquiries that indicate better conditions, are being received by the manufacturers in this section and occasionally there is a sale or two of iron made that gives some encouragement. It is firmly believed here that before the end of the coming month the buying movement will have started. Furnace companies are

not inclined to quote the lower figures for iron for delivery during the latter part of the year, confident that there will be better conditions prevailing. Some iron has been selling, immediate delivery, as low as \$13 per ton, No. 2 foundry. For delivery during the last half \$13.25 @ 13.50 is being asked and a small sale has been consummated for delivery during the last quarter of the year at \$13.75. Basic and charcoal iron are enjoying a little run. There is no change in conditions with the steel makers. The cast-iron pipe makers say that there could be a little improvement but their plants are in full operation.

Chicago

March 28—The general tone of the iron market seems stronger, though evidences of decided change are not common. Buying of pig iron is in most cases still of small lots; lots of more than 500 or 600 tons, however, are more frequently sold and there are inquiries indicating a large tonnage that undoubtedly will be placed as soon as the market shows signs of strengthening. No. 2 Southern foundry remains at \$13 Birmingham minimum (\$17.35 Chicago) and No. 2 Northern sells at \$18@18.50. Most of the business is being done in Southern, but Northern interests are looking more actively for contracts and are selling considerable tonnage outside of the field in which their iron naturally has preference for special uses. Northern charcoal iron is in fair demand at \$19@19.50. Sales are chiefly for second quarter. Furnace interests have weakened to the extent of being willing to contract for good-sized tonnage requirements of the last half at practically the same prices as for requirements of the next three months, but the melter is cautious. He is doing well from his point of view, under his present policy, and does not see why he should change it. For iron and steel products the market continues strong, though not with great activity of buying apparent anywhere. Coke is steady, in good demand and supply, at \$5.75 for the best Connellsville.

Cleveland

March 28—The ore market remains quiet with no new business.

Pig Iron—Quite a number of inquiries for foundry and forge iron are pending, the closing being a question of prices. It is believed that furnaces will make concessions rather than let the business get away. Nominal quotations are \$18.65 @ 18.90 for bessemer; \$16.50 @ 16.75 for No. 2 foundry, Cleveland delivery.

Finished Material—The heaviest business is in bars, and mills are slow in making deliveries. Some concessions are reported on big contracts. Jobbers report business good.

Philadelphia

March 30—Whatever influences are exerted on pig-iron quotations outside of local market demand during the rest of the year will probably come from new conditions west of the Alleghenies where increased blast-furnace capacity will play an important part. It is generally admitted that the high level has been reached and that nothing but a vigorous consumptive demand will preserve prices at the present level. Eastern makers claim that the situation in the East will not be materially affected by conditions in the West but may be affected by the Southern furnace interests, if they should be obliged to force a market for their products. Quotations remain substantially as last week, \$18@18.25 for No. 2X foundry and \$17.50 for good grades of Southern. Gray forge has been as low as \$17 in this market. Basic iron is strong at \$18@18.50 but large business has not been reported recently.

Steel Billets—The conservative policy of buyers still continues.

Bars—Sales of small lots are more frequent.

Sheets—Sheets hold their own well and outside figures are promptly paid on early deliveries. Manufacturers deny that there is any shading.

Pipes and Tubes—Merchant-pipe discounts have increased slightly and further concessions are expected.

Plates—Heavy orders for plates continue to come in or rather specifications on orders placed some time ago. Large quantities of plates will be wanted for shipyards in this locality.

Structural Material—The aggregate of business for the week is above the average, both for bridge building and for general construction work.

Scrap—Scrap is moving at about the usual rate, and large buyers recently resolved to hold off. There is not enough railroad scrap for the mills and it is picked up at the outside price.

Pittsburg

March 29—The iron and steel market shows an improvement in actual business being placed, and in sentiment. The rate of bookings upon finished-steel products by the Steel Corporation has steadily increased until it is about equal to current production, so that the corporation is breaking even. Outside steel companies are doing as well, if not better. The major part of the business is in specifications on old contracts, there being a moderate amount of new business, almost wholly for early delivery, particularly in the next three months.

There is no tendency toward higher prices at any point, and there seems to be little expectation anywhere, on the part of either buyers or sellers, that prices will advance from the present level even

should demand improve further. On the other hand there are no material recessions. Some sheet and wire products continue to be shaded on occasion, but to no greater extent than a month ago.

Reports that some agricultural-implementation business in steel bars for the year beginning next July had been booked are officially denied. The business has not come to a head yet, and the only important bookings in this trade have been two or three contracts by the Illinois Steel Company, to July 1, with agricultural-implementation interests which had exhausted their contracts. The importance of the agricultural bar tonnage is overrated; at best it amounts to only about 300,000 tons a year, while the total tonnage of merchant-mill products is about 6,000,000 tons. Steel bars are 1.45@1.50c., depending on delivery. Demand for hoops and bands is exceptionally heavy, particularly with the stamping trade.

Pig Iron—The market is almost stagnant, from surface appearances, but there is really a fair amount of business done in foundry iron in a quiet way. There is no demand for basic iron, but prices seem to be firmer and it is doubtful if \$16, Valley, could be shaded, while \$16.25 might have to be paid for extended delivery. Bessemer is extremely quiet, and is quotable nominally at \$17.50, Valley, it being understood that there are offerings at this figure, although there is no definite inquiry. The Valley market on foundry iron has become pretty steady at \$16 asked and it would require very special circumstances to develop any cut from this level. Southern iron continues weak. Several sales have been made by furnaces for second quarter at \$12.50, Birmingham, for No. 2, while gray forge has sold at \$11.25. At \$12.50 for No. 2, Southern iron is \$1 lower, relative to Valley iron at \$16, than the average of 1908 and 1909.

Steel—The market for open-hearth billets is, if anything, stronger and the top asking prices of a few weeks ago have been paid for a few lots for early delivery, and as high as \$29, Pittsburg, is reported as paid in an extreme case for 4x4 billets, while small billets continue to command \$30 or higher. Regular prices, for ordinary delivery, continue quotable as follows: bessemer billets, \$27@27.50; open-hearth billets, \$27.50@28; sheet bars, \$28.50@29 per ton.

Ferromanganese—The market has been growing softer, and demand is light. A few sales of prompt have been reported at \$42, Baltimore, while second quarter is quotable at about \$42.50. On April 1 the freight, Baltimore to Pittsburg, which was advanced January 1 from \$1.95 to \$2.30, will be put back to the old figure.

Sheets—There is a moderately good demand and most mills are adhering to regular prices. Two or three, which were optimistic late last year and did not participate largely in the heavy business then

being placed, are shading about \$2 a ton. Regular prices are 2.40c. on black, 28 gage, 3.50c. on galvanized, \$1.70 per square on painted corrugated roofing and \$3 on galvanized corrugated roofing. Blue annealed sheets are nominally 1.75c. for 10 gage, but bring 1.90c. for prompt delivery.

FOREIGN IRON TRADE

British Iron Trade—Exports and imports of iron and steel in Great Britain, two months ended Feb. 28, as valued by Board of Trade returns:

	Exports.	Imports.	Excess.
Iron and steel	£ 6,587,356	£ 1,361,764	Ex. £ 5,225,592
Machinery	4,029,568	648,955	Ex. 3,380,613
New ships	2,285,981		Ex. 2,285,981
Total	£12,902,905	£ 2,010,719	Ex. £10,892,186
Total, 1909	10,656,618	1,881,385	Ex. 8,775,233

Increase in exports, £2,246,287, or 21.1 per cent.; increase in imports, £129,334, or 6.9 per cent. The quantities of iron and steel reported were, in long tons:

	1909.	1910.	Changes.
Exports	571,002	718,890	I. 147,888
Imports	181,911	205,962	I. 24,051

Exports of scrap iron and steel, not included above, were valued at £72,465 in 1909, and £128,620 in 1910; imports were £6795 in 1909, and £11,919 this year.

British Iron Ore Imports—Imports of iron ore into Great Britain, two months ended Feb. 28, were 876,726 long tons in 1909, and 1,111,158 in 1910; increase, 234,432 tons. Of the imports this year, 826,175 tons were from Spain.

German Steel Syndicate—The following statement shows the full business of the Stahlwerks Verband in 1909, the first column showing the total allotments or allowances to the several works, and the second the actual deliveries made on those allotments; the figures are in metric tons:

	Allotments.	Deliveries.	Difference.
Billets, blooms, etc.	1,367,893	1,503,453	Ex. 135,560
Railr'd material	2,405,789	1,847,440	Def. 558,349
Shapes	2,392,816	1,614,702	Def. 778,114
Bars	3,449,271	2,908,127	Def. 546,144
Sheets and plates	964,578	881,826	Def. 82,752
Wire-rods	780,669	673,942	Def. 106,717
Forgings and castings	637,200	479,200	Def. 158,000
Tubes	141,336	95,525	Def. 45,811
Total	12,139,542	9,999,215	Def. 2,140,327

The only group showing an excess of deliveries over allotments was half-finished material—blooms, billets and similar articles. The total deliveries were 82.4 per cent. of the total allotments for the year.

German Iron Trade—Exports and imports of iron, steel and machinery in Germany, month of January, metric tons:

	Exports.	Imports.	Excess.
Iron and steel	339,537	39,869	Exp. 299,668
Machinery	24,288	3,692	Exp. 20,596
Total	363,825	43,561	Exp. 320,264
Total, 1909	284,237	36,539	Exp. 247,698

Imports of iron ore, 628,416 tons; exports, 248,307 tons. Imports of manganese ore, 31,018 tons; exports, 277 tons.

METAL MARKETS

New York, March 30—The metal markets do not show much change, and are still inclined to quiet and slight depression, with only small exceptions.

Our index number for the metals, calculated on the approximate production and sales of pig iron, copper, tin, lead, zinc and aluminum, was 127 for the month of January; 124 for February. These figures were reported incorrectly last week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1910	\$ 2,937,134	\$ 3,063,116	Imp. \$ 125,982
" 1909	8,860,814	3,576,444	Exp. 5,284,370
Year 1910	9,100,266	6,194,473	" 2,905,793
" 1909	16,696,170	6,966,627	" 9,699,543
Silver:			
Feb. 1910	4,588,619	3,155,329	Exp. 1,433,290
" 1909	4,852,549	3,508,935	" 1,343,614
Year 1910	9,086,923	7,403,683	" 1,683,240
" 1909	9,394,643	7,173,687	" 2,220,956

Exports from the port of New York, week ended March 26: Gold, \$1,002,000, including \$777,000 French gold coin in transit to Cuba; silver, \$989,056, chiefly to London. Imports: Gold, \$104,056; silver, \$72,859, from the West Indies and Mexico.

Movement of gold and silver through the port of San Francisco, two months ended Feb. 28:

	Exports.	Imports.	Excess.
Gold	\$1,970,208	\$272,013	Exp. \$1,698,195
Silver	1,111,200	531,895	Exp. 579,305

Exports of silver from London to the East from Jan. 1 to March 17, reported by Messrs. Pixley & Abell:

	1909.	1910.	Changes.
India	£ 918,000	£1,265,500	I. £ 347,500
China	657,000	904,500	I. 247,500
Straits	82,800		D. 82,800
Total	£1,657,800	£2,170,000	I. £ 512,200

India Council bills sold in London at an average of 16.13d. per rupee.

Gold—The price of gold on the open market in London was slightly higher, at 77s. 9½d. per oz. for bars. American coin was exchanged at 76s. 5d. per oz. Supplies arriving, which were chiefly from South Africa, were divided between London and the Continental banks.

Platinum—Business is steady and the market has a firm tone. Reports from Europe indicate that prices will be at least maintained. Dealers ask \$29@29.50 per oz. for refined platinum, and \$34.50 per oz. for hard metal.

Our special correspondent writes from St. Petersburg under date of March 17, that prices show little change. In Ekaterinburg 6.05 rubles per zolotnik—\$22.75 per oz.—is quoted for small lots; in St. Petersburg 24,000 rubles per pood—\$23.52 per oz.—both prices for crude metal, 83 per cent. platinum.

The total yield of platinum in Russia in 1909 is reported at 312 poods, or 164,237 oz.; an increase of 14 poods over the previous year.

Silver—The market has continued firm and closes at 24 $\frac{1}{8}$ d. in London. The price in India today is the same as it was just before the extra duty was imposed, proving that when it is a question of luxury, as silver is in the bazaars, the addition of a small percentage to the price has little influence on the demand during a period of prosperity.

SILVER AND STERLING EXCHANGE						
Mar.	24	25	26	28	29	30
New York....	52	52	52 $\frac{1}{2}$	52 $\frac{1}{2}$	52 $\frac{1}{2}$	52 $\frac{1}{2}$
London...	25 $\frac{1}{8}$	25 $\frac{1}{8}$	24 $\frac{1}{2}$	24 $\frac{1}{2}$	24 $\frac{1}{2}$	24 $\frac{1}{2}$
Sterling Ex..	4.8705	4.8705	4.8710	4.8715	4.8730	4.8750

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper, Tin, Lead and Zinc

Mar.	Copper.			Tin.	Lead.			Zinc.
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	St. Louis, Cts. per lb.	
24	13 $\frac{1}{2}$	13 $\frac{1}{2}$	58 $\frac{1}{2}$	32 $\frac{1}{2}$	4.37 $\frac{1}{2}$	4.22 $\frac{1}{2}$	5.35	
25	13 $\frac{1}{2}$	13 $\frac{1}{2}$	....	32 $\frac{1}{2}$	4.37 $\frac{1}{2}$	4.22 $\frac{1}{2}$	5.35
26	13 $\frac{1}{2}$	13 $\frac{1}{2}$	....	32 $\frac{1}{2}$	4.37 $\frac{1}{2}$	4.22 $\frac{1}{2}$	5.35
28	13 $\frac{1}{2}$	13	....	32 $\frac{1}{2}$	4.37 $\frac{1}{2}$	4.22 $\frac{1}{2}$	5.40
29	13 $\frac{1}{2}$	13	58 $\frac{1}{2}$	33	4.37 $\frac{1}{2}$	4.22 $\frac{1}{2}$	5.40	
30	13 $\frac{1}{2}$	13	58	33 $\frac{1}{4}$	4.37 $\frac{1}{2}$	4.22 $\frac{1}{2}$	5.40	

London quotations are for long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—Business has again been of small volume, and as the week progressed there has appeared more anxiety among sellers to find a market for their product, but the lower prices which have been named have so far not brought out buying orders except in a retail way. Such sales as have been effected have been chiefly for foreign delivery, which business has been done at 13.10 to 13.20, according to shipment. Most of the agencies are offering electrolytic for domestic delivery at 13 $\frac{3}{8}$, delivered 30 days, equivalent to about 13.20, cash, New York, and some transactions have been made at that price and lower. The market for Lake copper has been extremely dull and quotations are essentially nominal. Some small sales of fancy brands have been made as high as 13 $\frac{3}{4}$ c. The closing quotations are reported at 13 $\frac{3}{8}$ @13 $\frac{3}{8}$ c. for Lake, and 13@13 $\frac{1}{4}$ c. for electrolytic in cakes, wirebars and ingots. Casting copper is quoted nominally at 12 $\frac{7}{8}$ @13 $\frac{1}{8}$ cents.

Copper sheets are 19@20c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire is 14 $\frac{3}{4}$ c. base, carload lots at mill.

The London standard market has also shown a downward tendency and closes barely steady at £58 for spot, and £59 2s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £61; best selected, £61@61 10s.; strong sheets, £70@71 per ton.

The March statistics of the Copper Producers' Association will be published on April 8.

Copper exports from New York and Philadelphia for the week were 2950 long tons. Our special correspondent gives the exports from Baltimore at 996 tons copper.

Copper in March—The large buying of copper that began toward the end of February continued into March, the sales from Feb. 24 to March 5, probably aggregating in the neighborhood of 100,000,000 lb. However, these large transactions resulted in only a slight increase in the price, electrolytic never rising above 13 $\frac{1}{2}$ c. The statistics published on March 10 acted as a damper upon the trade and with the subsequent increase of pessimistic feeling the market sagged off under comparatively small sales, closing at 13 $\frac{1}{8}$ c. for electrolytic.

Tin—The London market has retained its strength and prices show a further advance. The bull party's position was strengthened by reports that the strike at the Welsh tinplate mills had been averted and that deliveries into American consumption for this month are comparatively large ones. An improvement in the statistical position of the metal is, therefore, confidently expected, and the close is cabled as steady at £150 15s. for spot, and £152 15s. for three months.

There was no great activity in the domestic market, consumers showing no interest except in spot material, which is held very firmly, and at the close tin can be bought at about 33 $\frac{1}{4}$ cents.

Lead—Demand for this metal has shown some improvement and prices at the close are steadier at 4.37 $\frac{1}{2}$ @4.40c. New York, and 4.22 $\frac{1}{2}$ @4.25c. St. Louis.

The weakness in lead appears to be wholly confined to the market for spot and early deliveries. Notwithstanding the superficial feeling of discouragement about this metal, there appears to be an undercurrent of strength and when it is a matter of contract for future deliveries dealers are disinclined to consider business at present prices.

The London market for lead is unchanged at £12 18s. 9d. for Spanish, and £13 1s. 3d. for English.

Spelter—Orders have been coming forward somewhat more freely, and the market has slightly advanced during the

week, closing steady at 5.40@5.42 $\frac{1}{2}$ c. St. Louis, and 5.55@5.57 $\frac{1}{2}$ c. New York.

Considerably more business in spelter was transacted during last week than in the week previous, sales having been made both to consumers and to speculators. On business with speculators as high as 5.45c. St. Louis, has been done, but consumers have found no difficulty in buying at 5.40. The feeling in this market is somewhat more hopeful.

New York quotations for spelter, March 24-26 inclusive, were 5.50@5.55c.; March 28-30, inclusive, 5.55@5.57 $\frac{1}{2}$ cents.

The London market is unchanged at £23 for good ordinaries and £23 5s. for specials.

Base price of zinc sheets is \$7.75 per 100 lb. f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—While the market continues good and business is active, prices are unchanged, 23 $\frac{1}{4}$ @23 $\frac{3}{4}$ c. being quoted for No. 1 ingots, New York. Sellers are still reluctant to quote far ahead, in view of the strong position.

Antimony—The market continues dull, and prices are inclined to be weaker. Cookson's is quoted at 8 $\frac{1}{4}$ @8 $\frac{3}{8}$ c. per lb., while 7 $\frac{7}{8}$ @8c. is still asked for U. S., and 7 $\frac{1}{4}$ @7 $\frac{3}{8}$ c. for outside brands.

Quicksilver—The market is easier but prices are unchanged. New York quotation is \$49 per flask of 75 lb.; jobbers ask 73@74c. per lb. for small lots. San Francisco, \$48@49 for domestic orders and \$2 less for export. The London price is £9 5s. per flask, with £9 2s. 6d. asked by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot, from 50c. for 500-lb. lots, up to 55c. for 200-lb. lots. The price for electrolytic is 5c. higher.

Magnesium—The price of pure metal is \$1.50 per lb. for 100-lb. lots f.o.b. New York.

Cadmium—Current quotations are 65 @70c. per lb. in 100-lb. lots at Cleveland, Ohio. Prices in Germany are 500 @550 marks per 100 kg.—average 56.7c. per lb.—f.o.b. works in Silesia.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, two months ended Feb. 28, figures in long tons, except quicksilver, which is in pounds:

Metals:	Imports.	Exports.	Excess.
Copper, long tons	28,137	10,362 Imp.	17,775
Copper, 1909....	21,896	13,269 Imp.	8,627
Tin, long tons....	8,399	7,901 Imp.	498
Tin, 1909.....	7,150	6,658 Imp.	492
Lead, long tons..	33,993	7,962 Imp.	26,031
Lead, 1909.....	37,823	6,338 Imp.	31,485
Spelter, 1 $\frac{1}{2}$ tons..	21,033	1,602 Imp.	19,431
Spelter, 1909....	16,915	1,153 Imp.	15,762
Quicksilver, lb....	499,082	107,968 Imp.	391,114
Quicksilver, '09	401,157	171,786 Imp.	229,371

Ores:	Imports.	Exports.	Excess.
Tin ore and con.	3,963	.....	Imp. 3,963
Tin ore, 1909...	2,587	.....	Imp. 2,587
Pyrites.....	131,039	.....	Imp. 131,039
Pyrites, 1909...	136,790	.....	Imp. 136,790

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Of the imports in 1909 the United States furnished in all 26 tons copper matte, 11,966 tons fine copper and 3115 tons lead. This lead was chiefly Mexican, refined in this country.

Zinc and Lead Ore Markets

Platteville, Wis., March 26—The highest price paid this week for zinc ore was \$45 per ton; the base price, 60 per cent. zinc, was \$43@44.50. For 80 per cent. lead ore \$50 per ton was paid.

SHIPMENTS, WEEK ENDED MAR. 26.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point...	654,800	56,000	.....
Platteville.....	477,980	.....	527,700
Benton.....	261,000	.....	.....
Galena.....	222,000	.....	.....
Highland.....	126,200	.....	.....
Cuba City.....	83,390	84,120	.....
Linden.....	72,760	85,030	.....
Livingston.....	.....	60,000	.....
Total.....	1,898,130	285,150	527,700
Year to date.....	18,453,770	1,461,199	3,415,060

In addition to the above there was shipped during the week to the separating plants, 2,080,195 lb. zinc concentrates.

Joplin, Mo., March 26—The highest price paid for zinc sulphide ore was \$47 per ton, the base ranging down from \$44 early in the week to \$43 for the best grades and as low as \$40 for medium grades. Zinc silicate ore sold on a base of \$18@24 per ton of 40 per cent. zinc. The average price, all grades, was \$38.96 per ton. Lead ore declined to \$50 per ton.

The production was heavy on both zinc and lead ore, and with comparatively light shipments except from Webb City the reserve stock is again increasing, reaching at the end of this week 7000 tons.

The zinc ore producers this week secured a formal certificate for their new organization, and it is rumored that the

SHIPMENTS, WEEK ENDED MAR. 26.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,809,740	523,520	\$114,092
Joplin.....	1,657,610	222,360	41,196
Alba-Neck.....	702,140	.....	16,148
Duenweg.....	938,170	44,210	15,957
Granby.....	1,029,320	17,000	14,055
Badger.....	582,110	15,980	12,806
Galena.....	434,070	74,290	10,972
Aurora.....	405,900	75,480	8,006
Spurgeon.....	421,520	67,830	7,296
Carthage.....	292,380	.....	6,431
Quapaw.....	294,700	11,810	6,328
Miami.....	272,420	53,660	4,337
Oronogo.....	120,680	60,960	3,348
Sarcoxite.....	119,540	.....	2,510
Cave Springs.....	117,790	.....	2,473
Jackson.....	119,520	.....	2,444
Carl Junction.....	64,620	.....	1,389
Saginaw.....	25,730	21,490	1,048
Wentworth.....	35,210	.....	350
Totals.....	12,443,180	1,188,590	\$271,176
3 months.....	140,546,260	21,223,930	\$3,501,091
Zinc value, the week, \$241,479;	.....	3 mos., \$2,919,532	.....
Lead value, the week, 29,697;	.....	3 mos., 581,559	.....

secretary's office has been tendered Mr. Siebenthal of the Geological Survey, but as yet his acceptance has not been received. Webb City members, who have maintained an organization with Mr. Hutcheson as secretary, have insisted that he be retained. The organization has been six weeks in forming. Perfect harmony has not existed, and there is strong rumor that the Webb City contingent will continue their organization and withdraw from the new one.

MONTHLY AVERAGE PRICES.

Month.	ZINC ORE.				LEAD ORE.	
	Base Price.		All Ores.		All Ores.	
	1909.	1910.	1909.	1910.	1909.	1910.
January.....	\$41.25	\$47.31	\$38.46	\$45.16	\$52.17	\$56.99
February.....	36.94	40.69	34.37	39.47	50.50	53.64
March.....	37.40	.....	34.71	.....	50.82	.....
April.....	38.63	.....	37.01	.....	55.63	.....
May.....	40.06	.....	37.42	.....	56.59	.....
June.....	44.15	.....	40.35	.....	57.52	.....
July.....	43.06	.....	41.11	.....	53.74	.....
August.....	48.25	.....	44.54	.....	57.60	.....
September.....	47.70	.....	44.87	.....	56.11	.....
October.....	49.50	.....	45.75	.....	55.02	.....
November.....	51.31	.....	48.29	.....	53.94	.....
December.....	49.45	.....	47.57	.....	55.26	.....
Year.....	\$43.98	.....	\$41.20	.....	\$54.60	.....

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

CHEMICALS

New York, March 30—The general market continues steady with no changes of importance, but rather a firm tendency.

Copper Sulphate—Business is good and the market steady. Prices are unchanged at \$4.10 per 100 lb. for carload lots and \$4.35 per 100 lb. for smaller orders.

Nitrate of Soda—Sales continue large and spot nitrate holds firm at 2.15c. per lb. Futures remain at 2.07½c. per lb. in view of the large imports, present and prospective.

Arsenic—The market is weaker. Sales for the week are reported at about 100 tons. Quotations are easier and are given at \$2.37½@2.50 per 100 lb. for white arsenic.

MINING STOCKS

New York, March 30—A holiday for two days broke into the trading this week, the Exchange having adjourned from Thursday over to Monday. Outside of this the general market was confused and for the most part weak and reactionary. The Granby flurry contributed to this, and it was helped by the threat of labor troubles in the West and by the bad position in London. Amalgamated broke several points, and other shares were lower.

On the Curb the copper shares were all

weak, and some lost considerably. The trading was not heavy, however. Some trading was done in Cobalt stocks, but generally at reduced prices. Nevada gold stocks were fairly steady, but on small business.

A small sale of Homestake of South Dakota was reported, 60 shares changing hands at \$88.25 per share.

At public auction on March 23 there were sold 7500 shares Alice Gold and Silver Mining Company at \$1.50 per share; 98,112 shares Argentite-Cobalt Company at 0.5c. per share; 11,510 shares Dominican Placer Mining Company at \$110 for the lot.

Boston, March 29—Copper shares have been utterly demoralized, although at the present writing some recovery has followed the low levels and the belief is expressed that the worst has been seen. Granby Consolidated has been the worst sufferer, with a break from \$84 to \$37 per share, during the week, although recovery to \$45 followed today. The break in the price of these shares was savage and came as a surprise, as the stock has been classed as among the gilt-edge mining issues.

The so called Amster stocks come next in importance in the decline. Arizona Commercial went off \$12.50 in the week's time, making a low at \$20.75, with \$2.25 recovery from the low. Support was not proffered in the slightest degree, and the decline in this stock has done considerable harm to accounts, as Boston has had the highest regard for its president, who has had the reputation of always making good. Shannon and Boston Corbin each fell sharply in sympathy with the decline of Arizona Commercial.

The new Lake stocks also suffered in the general declines, although the pressure was less than in most other issues. Lake fell about \$10, Indiana about \$8 and North Lake about the same amount. Weak margined accounts have been wiped out and the market in general is in better condition, although some serious individual losses have been incurred.

Declines were general throughout the list, although those mentioned were the most serious.

Assessments

Company.	Delinq.	Sale.	Amt.
Alpha Con., Nev.....	Mar. 12	Apr. 7	\$0.05
Bader, Cal.....	Feb. 24	Mar. 14	0.10
Belcher, Nev.....	Mar. 9	Mar. 29	0.10
Cardiff, Utah.....	Mar. 10	Mar. 28	0.00
Central Eureka, Nev.....	Mar. 13	Apr. 23	0.02
Chollar, Nev.....	Mar. 8	Mar. 31	0.10
Columbus Con., Utah.....	.....	Apr. 11	0.25
Confidence, Nev.....	Mar. 25	Apr. 15	0.20
Crown Point, Nev.....	Mar. 8	Mar. 28	0.10
Gould & Curry, Nev.....	Mar. 14	Apr. 6	0.10
Hale & Norcross, Nev.....	Mar. 9	Mar. 31	0.10
Hancock, Mich.....	May 2	.....	3.00
New Arcadian, Mich.....	Mar. 10	.....	1.00
Ojibway, Mich.....	Mr Oct.	.....	2.00
Oneco, Mich.....	Feb. 13	.....	1.00
Overman, Nev.....	Apr. 6	Apr. 27	0.10
Potosi, Nev.....	Apr. 5	Apr. 28	0.10
Seg. Belcher, Nev.....	Mar. 8	Mar. 28	0.10
Seven Troughs Mon., Utah.....	Mar. 12	Apr. 2	0.00
Sierra Nevada, Nev.....	Apr. 7	Apr. 27	0.10
South Columbus, Utah.....	Mar. 30	Apr. 30	0.02
Union, Nev.....	Mar. 7	Mar. 31	0.10
Yellow Jacket Nev.....	Mar. 7	Apr. 11	0.10

Curb stocks showed sympathetic weakness. The real feature was the break in First National from \$4 to \$2.87½ tonight. This decline was accompanied by reports of a possible \$2 assessment. The company has some refunding to do which accounts in part for the weakness.

STATISTICS OF COPPER.

Table with 4 columns: Month, United States Product'n., Deliveries, Domestic., Deliveries for Export. Rows include months III 1909 to XII 1909, and years I, 1910 and II.

VISIBLE STOCKS.

Table with 4 columns: Month, United States, Europe, Total. Rows include months III 1909 to XII 1909, and years I, 1910 and II.

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

Monthly Average Prices of Metals SILVER

Table with 5 columns: Month, New York, London, 1909, 1910. Rows include months January to December and a Total row.

New York, cents per fine ounce; London, pence per standard ounce.

COPPER.

Table with 6 columns: NEW YORK (Electrolytic, Lake), London. Rows include months January to December and a Year total.

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Table with 6 columns: Month, 1909, 1910, Month, 1909, 1910. Rows include months January to June and an Av. Year total.

Prices are in cents per pound.

LEAD

Table with 6 columns: Month, New York, St. Louis, London, 1909, 1910. Rows include months January to December and a Year total.

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Table with 6 columns: Month, New York, St. Louis, London, 1909, 1910. Rows include months January to December and a Year total.

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PRICES OF PIG IRON AT PITTSBURG.

Table with 8 columns: Bessemer, Basic, No. 2 Foundry, 1909, 1910. Rows include months January to December and a Year total.

STOCK QUOTATIONS

Table with 4 columns: Name of Comp., Bid., Name of Comp., Clg. Rows include COLO. SPRINGS and SALT LAKE sections.

SAN FRANCISCO. Mar. 29.

Table with 4 columns: Name of Comp., Clg., Name of Comp., Clg. Rows include COMSTOCK STOCKS and MISC. NEVADA.

N. Y. EXCH. Mar. 29

Table with 4 columns: Name of Comp., Clg., Name of Comp., Clg. Rows include various exchange items.

N. Y. CURB Mar. 29

Table with 4 columns: Name of Comp., Clg., Name of Comp., Clg. Rows include various curb items.

BOSTON CURB Mar. 29

Table with 4 columns: Name of Comp., Clg., Name of Comp., Clg. Rows include various Boston curb items.

†Last quotation.

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Denatured..... " .42		MANGANESE—	Ground quartz, ord'ry, lg. ton. 7.00@15.00
Refined wood, 95@97%..... " .52@.57		Foreign, crude, powdered:	Silex, ground..... " 7.00@15.00
ALUM—Lump 100 lb. \$1.75		70@75% binioxide..... lb. .01@.01½	Silex, floated..... " 35.00@40.00
Ground..... " 1.85		75@85% binioxide..... " .01½@.01½	Lump quartz..... " 5.00@5.50
Chrome Alum..... " .04½@.05		85@90% binioxide..... " .01½@.04	Glass sand..... " 2.75
ALUMINUM—Sulphate, com'l. lb.	1.50@1.75	90@95% binioxide..... " .06½	SILVER—Nitrate, crystals oz. .33½@.36½
AMMONIA—24 deg. lb. " .04½@.05½		Ore, 80%-85%..... sh. ton. 16.00@32.50	SODIUM—Acetate lb. .04½@.05
" 26 deg. lb..... " .04½@.05½		MARBLE—Flour sh. ton. 7.00@9.00	" Alkali" per 100 lb., 58/48..... 90@.95
AMMONIUM—		MINERAL WOOL—	Bicarb. soda, per 100 lb..... 1.00@1.30
Bromide..... lb. .28		Slag, ordinary..... sh. ton. 19.00	Soda, caustic, per 100 lb., 78/60..... 1.72½@1.85
Carbonate..... " .08@.08½		Selected..... " 25.00	Soda, caustic, powdered..... .02½@.03
Muriate grain..... " .05½@.06½		Rock, ordinary..... " 32.00	Salt cake, per 100 lb., bulk..... .50@.60
Lump..... " .09½@.09½		MONAZITE SAND—	Salt cake, bbl..... .85@.95
Sulphate, 100 lb..... " 2.75@3.00		Guar. 97%, with 5% Thorium	Soda, monohydrate, per lb..... 1.30@1.75
Sulpho-cyanide com'l..... " .25		oxide, normal..... lb. .08 and up	Bichromate..... lb. .05½@.06½
chem. pure..... " .35		NICKEL—	Bromide..... " .20
ANTIMONY—needle, lump lb. .04½@.04½		Oxide, crude, lb. (77%) for fine	Chlorate, com'l..... " .08½@.09½
Oxide..... " .07½@.08		metal contained..... .47	Cyanide, 120-130% KCN, per 100%
ARSENIC—white " .02½@.02½		Sulphate, single..... lb. .10½@.11	Carloads (30,000 lb.)..... lb. 18c.
Red, outside brands..... " .07		Sulphate, double..... " .05½@.08	5-ton lots..... " 18½c.
Saxony..... " .07½@.08		NITRATE OF SODA—	Less than 5 tons..... " 20
ASPHALTUM—		100 lb. 95%..... 2.07½@2.15	Hyposulphite, Am..... 1.30@1.50
Barbadoes..... per ton. 70.00@80.00		95% for 1910..... 2.07½@2.15	Phosphate..... 100 lb. 2.10@2.40
West Indies..... " 20.00@60.00		96% is 2½@7½c. higher per 100 lb.	Prussiate..... " .08½@.09
Egyptian..... lb. .11@.16		OZOKERITE—best lb. .14@.17	Sal soda, f.o.b. N. Y..... " .60@.75
Gilsonite, Utah ordinary per ton.	32.00@40.00	PAINTS AND COLORS—	Foreign, f.o.b. N. Y..... " .80@1.00
Trinidad..... " 20.00@25.00		Litharge, Am. powdered..... lb. .06½@.06½	Silicate, com'l..... " .65@1.00
California..... per ton. 25.00@30.00		English glassmakers'..... " .08½@.09½	Sulphate, com'l (Glauber's salt)
BARIUM—		Lithopone..... " .03½@.07	100 lb. .60@.80
Carb. Lump, 80@90% lg. ton.	26.00@35.00	Metallic, brown..... sh. ton. 16.50@22.00	Sulphate, com'l, calcined..... 100 lb. .65@.85
Precipitated, 96@98%..... " 34.00@36.00		Red..... " 14.00@18.00	STRONTIUM—Nitrate lb. .07@.08
Powdered, natural..... lb. .02@.02½		Ocher, Am. common..... " 8.50@9.00	SULPHUR—Louisiana (prime) to
Chloride com'l..... ton. 35.00@38.00		Best..... " 12.00@15.00	New York..... lg. ton. 22.00 up
Nitrate powdered, in casks..... lb. .05@.06½		Dutch, washed..... lb. .02½@.03	To Boston, Philadelphia or
Blanc Fixe, dry, bbl..... per lb. .02½@.04		French, washed..... " .01½@.02	Baltimore..... " 22.50 up
BARYTES—		Paris green, pure, bulk..... " .17½@.20½	Roll..... 100 lb. 1.85@2.15
Am. Ground..... sh. ton. 12.00@15.00		Red lead, American..... " .06½@.07	Flour..... " 2.00@2.40
Floated..... " 17.00@19.00		Foreign..... " .08½@.09½	Flowers, sublimed..... " 2.20@2.60
Foreign floated..... " 20.00@23.00		Turpentine, spirits bbl., per gal.	Powdered commercial, bags
BLEACHING POWDER—35%		White lead, Am., dry..... lb. .05½@.06	Sicilian, extra qual., unmixed
100 lb..... 1.25@1.45		American, in oil..... " .07@.07½	seconds, crude brimstone
BLUE VITRIOL—(copper sul-		Foreign, in oil..... " .09@.09½	to New York..... lg. ton. \$22.00
phate), carload, per 100 lb.	4.00@4.35	Zinc white, Am. extra dry..... " .05½@.05½	TERRA ALBA—Fr.&Eng. 100lb.
BONE ASH lb. .02½@.04		French, process, red seal, dry..... " .07@.07½ 70@1.00
BORAX, sacks " .03½@.05		PHOSPHATES—Acid 55@60c. per unit	TALC—Domestic sh. ton. 12.00@20.00
CALCIUM—Acetate, gray, 100 lb.	1.75@2.00	*Fla., hard rock 77%..... 7.00@7.50	French..... " 15.00@25.00
Carbide, ton lots f.o.b. Niag-		land pebble 68%..... 3.75@4.00	Italian, best..... " 30.00@40.00
ara Falls, N. Y., for Jersey		†Tenn., 78@80%..... 5.00@5.50	TIN—Bi-chloride, 50° lb. .10
City, N. J..... sh. ton. 65.00		75%..... 4.75@5.00	Crystals..... " .22½@.24
Chloride, f.o.b. N. Y..... " 11.00@14.10		68@72%..... 4.25@4.50	Oxide, lb..... " .37@.40
CEMENT—Slag cement bbl. .75@1.25		‡So. Car. land rock 60%..... 3.50@4.00	URANIUM—Oxide " 2.20@4.25
Portland, Am. 500 lb..... " 1.50@1.60		*F.o.b. Florida or Georgia ports. †F.o.b. Mt.	ZINC—Chloride sol., com. 20° " .02½
Foreign..... " 2.25@2.90		Pleasant. ‡On vessel Ashley River, S. C.	Chloride, granular..... " .04½
" Rosendale," 300 lb..... " .85			Dust..... " .06½
(in sacks)..... " .65			Sulphate..... " .02@.02½
CHROME ORE—			
New Caledonia 50% ex. ship			
N. Y..... per lg. ton. 14.00@16.00			
Bricks, f.o.b. Pittsburg, per M.	175.00		
CLAY, CHINA—Am. common			
ex-dock, N. Y..... ton. 8.00@9.00			
Foreign..... " 11.50@18.00			
COBALT—Oxide lb. .80@.85			

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their output as a matter of private contract.