

The Shape of the Iron Blast Furnace

Factors Which Have Determined the Dimensions of the Stack in the Past and Are Likely to Govern Changes in the Future

BY HENRY M. HOWE*

For most of the ideas here presented I am indebted to the patient consideration of Frank Firmstone, F. L. Grammer, and J. E. Johnson, Jr., and to many interesting talks with Sir Lowthian Bell and James Gayley and E. S. Cooke. I doubt if any one of them agrees with all I say, and some of them certainly do not.

Though it is no doubt true that the present size and shape of the iron blast furnace have been reached in part empirically, and in another considerable part by reasoning which is none too convincing, it is nevertheless interesting, and it may be profitable, to seek the causes which through both empirical and reasoned trials, have guided the evolution of this wonderful engine to its present size, and to its shape, Fig. 1, a pair of truncated cones set end to end, the upper one upright and very acute, the lower one inverted and relatively obtuse.

Such a search as this for causes can hardly be expected to lead to very definite and positive conclusions. Nearly all that can be expected of it is that the hypotheses which it frames shall be sharp and clear cut, and therein fitted for consideration, and for improvement or rejection.

There are those who would refer the shape of the blast furnace chiefly to variations in the mechanical condition of the charge; others who would refer it in very large part to the need of having the rising gases pass evenly through the different parts of each horizontal section, neglecting neither the axial parts, nor the circumferential, nor the intermediate ones; and still others who would refer that shape to the variations in the volume of the gases in different parts of the furnace. To the bystander it certainly seems as if each of these elements was important, and as if the blast furnace, like the human body, had to comply with a great many different conditions, some not readily grasped, some limiting it in one way, some in another, and some having to be met by such compromise as can be devised.

The advantage which the large unit offers in most industrial operations, of economizing installation, labor, and administration, is reinforced in case of the iron blast furnace, as indeed in case of most metallurgical furnaces, by the farther

great advantage of lessening the proportion which the outer heat-radiating and hence heat-wasting surface bears to the whole mass, and hence to the unit of product; in short, of saving heat. Let us consider in what way the furnace builder's

the blast would penetrate relatively feebly to its center, that hence too great a difference in conditions between center and circumference would arise, and that from this difference serious unevenness of working would result. It is true that the width of the hearth has at the Lackawanna furnaces been increased to 17 ft., and as a result of these important experiments it may well prove that a hearth-width of much more than 12½ ft. can be used with advantage. In this event it may also follow that the furnace may be widened all the way from top to bottom, and the volume and rate of production be increased in a very important degree. Indeed, the reasoning which we shall follow tends to show that, if there is to be any important increase of size, it is more likely to be an increase in diameter than in height.

ANGLE OF BOSH

With the hearth diameter thus provisionally fixed at 12½ ft., the furnace designer naturally tries to gain volume as rapidly as possible by widening his furnace abruptly, and in this way comes the outward flaring bosh, which begins shortly above the tuyeres. In order that the increase of volume may be as great as the attendant conditions permit, the boshes are made as flat as practicable, i.e., the inverted cone of which the lower part of the furnace consists is made as obtuse as practicable. In practice it is found that the angle which the boshes make with the horizontal must not be less than 73 deg., and 76 deg. is a more usual angle.

If, now, we are asked what it is that prevents us from making the boshes still flatter, a very natural reason which suggests itself is that if they were flatter, the descending column of solid materials would not slide freely over them as its lower end is gradually eaten away by the burning of the coke and the melting of the ore and flux, or rather of the reduced iron, the gangue, the ash, and the flux, of which the last three in melting unite to form the slag.

In order to grasp the conditions here we should bear in mind that in the lower part of the furnace, as sketched in Fig. 2, the descending column of solids consists of coke only, because from the tuyeres to a level about 12 ft. above them the tem-

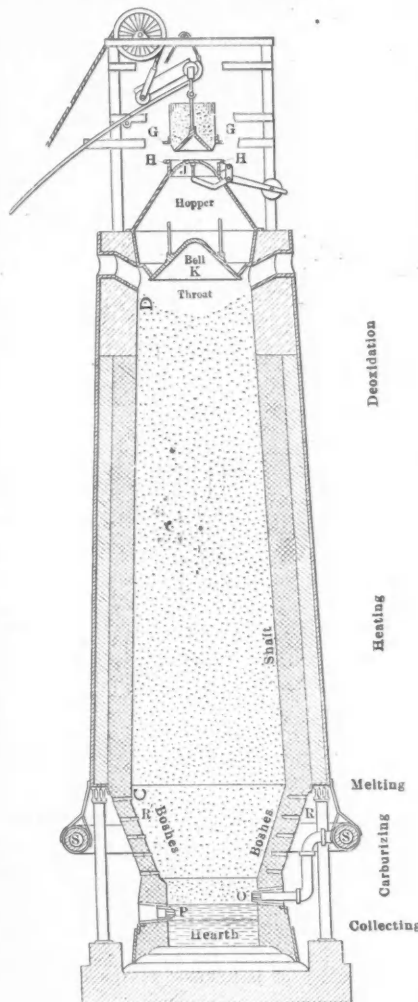


FIG. 1. SECTION OF ONE OF THE DUQUESNE BLAST FURNACES

G G, flanges on the ore bucket; H H, fixed flanges on top of furnace; J, counterweighted false bell; K, main bell; O, tuyere; P, cinder ratch; R R, water-cooled boxes; S, blast pipe.

natural desire to make his furnace and his output as large as possible is limited by the conditions of the case.

The width at the tuyeres has in general been limited to about 12½ ft. by the fear that, if the hearth were materially wider,

*Professor of metallurgy, School of Mines, of Columbia University.

perature is so high that everything but the coke melts, while past it the molten iron and molten slag trickle down.

To make the boshes needlessly steep, on the other hand, as in furnace No. 10, not only sacrifices room, but in fact also leads to irregular working. While we may not dogmatize as to the reasons for this, two independent ones suggest themselves. The first is that too steep a bosh tends to lead the rising gases to travel in undue proportion along the smooth walls and too little through the descending column of

degree of incipient jamming which lets the coke descend only as its lower end is quite free; yet if the bosh is steeper, and if the coke, therefore, descends more easily, it slides down so freely that it presses down into the molten layers of slag and iron collected at the bottom of the furnace, and there acts most energetically on them. Further, slight variations in the conditions vary the depth of this immersion of the coke in the ore and slag, and hence vary the degree to which this intense action of the coke on the slag

ing a possible contributory explanation of the observed fact that with too steep boshes the furnace works irregularly.

HOW FAR UP MAY THIS OUTWARD FLARE BE CARRIED?

In the very swift-running furnaces of the Pittsburg district, Fig. 1, this outward slope of the boshes stops short at about 12 ft. above the tuyeres, and is there replaced by a slight batter in the opposite direction, *CD* in Fig. 1. In other words, at this level the furnaces change from a relatively obtuse inverted cone to a very acute upright one. A reason assigned for this is that, at this level, the descending charge reaches a temperature so high that the gangue and the flux soften and become pasty. Below this level the column of solids descends even through the narrowing region of the boshes, and descends freely enough, because the only solid is the coke, itself perfectly dry and without suggestion of pastiness. But at this upper level, where the gangue and flux become pasty, they tend to cement the whole together, coke and all, into something like what a freshly-mixed concrete would be if it had but a small proportion of grout, and if that grout were very sticky, like tar. In order that this rather pasty mass shall descend with the necessary freedom as the coke below works down, it is said to be necessary that the furnace shall in this region of pastiness, grow wider downward, instead of growing wider upward, as it does at the boshes.

To this two objections are made: First, that such jamming does not occur; second, that it cannot occur. Let us examine these separately.

First, as to the alleged absence of jamming. In many of the older furnaces the outward batter of the boshes was prolonged far above this level, though somewhat steepened; and indeed, it was carried nearly midway toward the top of the furnace, as shown in furnaces Nos. 3, 5 and 7, which worked very well. This indeed shows that at least under those special conditions, it is wholly practicable for the charge to descend, even while in its pasty stage, through a region which grows narrower downward.

To this, in turn, it may be said that, though this may be practicable in case of relatively slow-running furnaces, and in case the slag is relatively fluid, or rather in case the slag passes rather quickly from the solid to a relatively fluid state, yet it is not practicable in case of a sticky, very calcareous slag, and of extremely rapid working, and the freedom of descent which that rapid working requires.

Second, as to the alleged impossibility of such jamming. It is held to be impossible that so wide a column, composed of such relatively small lumps, can possibly thus become so blocked, jammed, or engorged, even with the aid of the pastiness of the barely melting slag, that it would not descend freely between and past converging

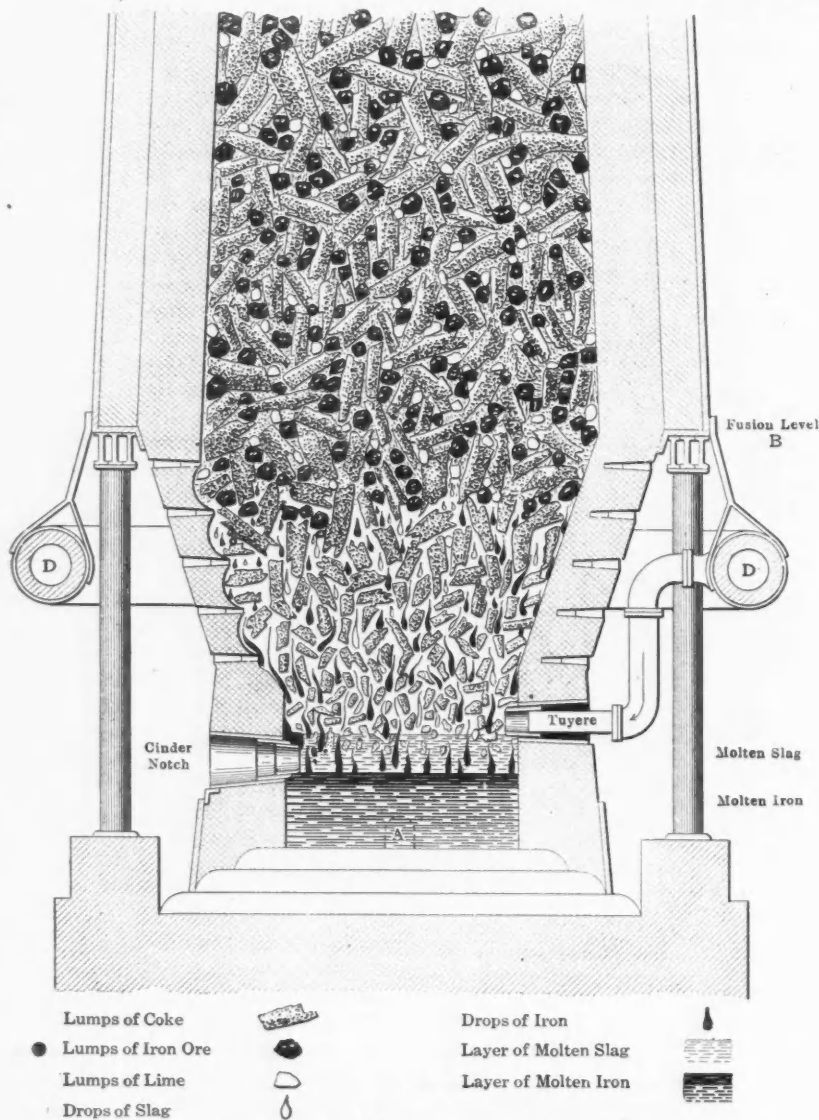


FIG. 2. LOWER PART OF THE BLAST FURNACE

NOTE—The ore and lime actually exist here, not in lump form, but in powder. They are shown in lump form simply because of the difficulty of presenting to the eye the powdered state.

solids, with the consequence that the axial ore may reach the lower part of the furnace insufficiently reduced. In short, this uneven distribution of the rising gases would make the reduction of the axial ore lag behind that of the circumferential ore, and thus set up unevenness of working.

The second is that, whereas with a flattish 76-deg. bosh the charge descends only as the lower end of the column is eaten away, because the constriction which the flatness of the bosh represents causes a

and iron takes place. With a flattish bosh the coke is held up enough so that it never dips materially into either slag or metal; with a steeper bosh the coke slides so freely that it does so dip, and dips to a depth which varies materially. It is this variation that causes serious variations in the degree to which the energetic action of coke on molten slag and iron takes place.

Be it understood that these statements are made tentatively, not as depicting the actual condition of things, but as indicat-

walls. Imagine, they say, that the materials before the tuyeres and hence to the top of the boshes, in No. 1, have been melted or burnt away, so that this space is empty. How is it possible that a truly supporting arch, or rather dome, of such fine lumps should stretch across a span as wide as 17 ft., and thus hold up the weight of the column above, without the aid of the lifting frictional action of the blast?

The answer is fivefold: First, if we may judge from description of what happens in many scaffoldings after the blast has been taken off, such arching does actually occur. A very trustworthy friend assures me that he has actually seen the coke arched across at or near the top of the boshes after the greater part of the

If this is possible with so smooth a substance as wheat¹, with its grains all of about the same size, and without any viscid material to act as a bond, it should be far easier at the top of the boshes, (1) because of the coarseness of the coke, (2) because of its roughness, (3) because of the great variations in the size of the lumps, which leads to "chinking in," and (4) because of the assumed presence of slag in its formative sticky state.

Fifth, if the outward flare of the boshes were extended up past the fusion zone, the charge in its pasty slag-forming stage might well have enough freedom of descent to prevent its actually arching across, or even forming the beginning of domes, and yet not have the much greater freedom of descent needed for the smooth and

THE DIAMETER AT THE TOP

It is of fundamental importance that the charge shall be distributed properly over the top of the furnace. There are serious difficulties in the way of making this distribution proper in case the furnace is very wide at the throat (Fig. 1). In practice the diameter is rarely greater than 16 ft. at this level. On the other hand, a narrow top has the disadvantages of restricting the room available for the charge in the upper part of the furnace; of throttling back the rising gases and so increasing the power needed for driving them through the furnace; and of giving them so great a velocity that they entrain much of the fine ore and carry it out of the furnace.

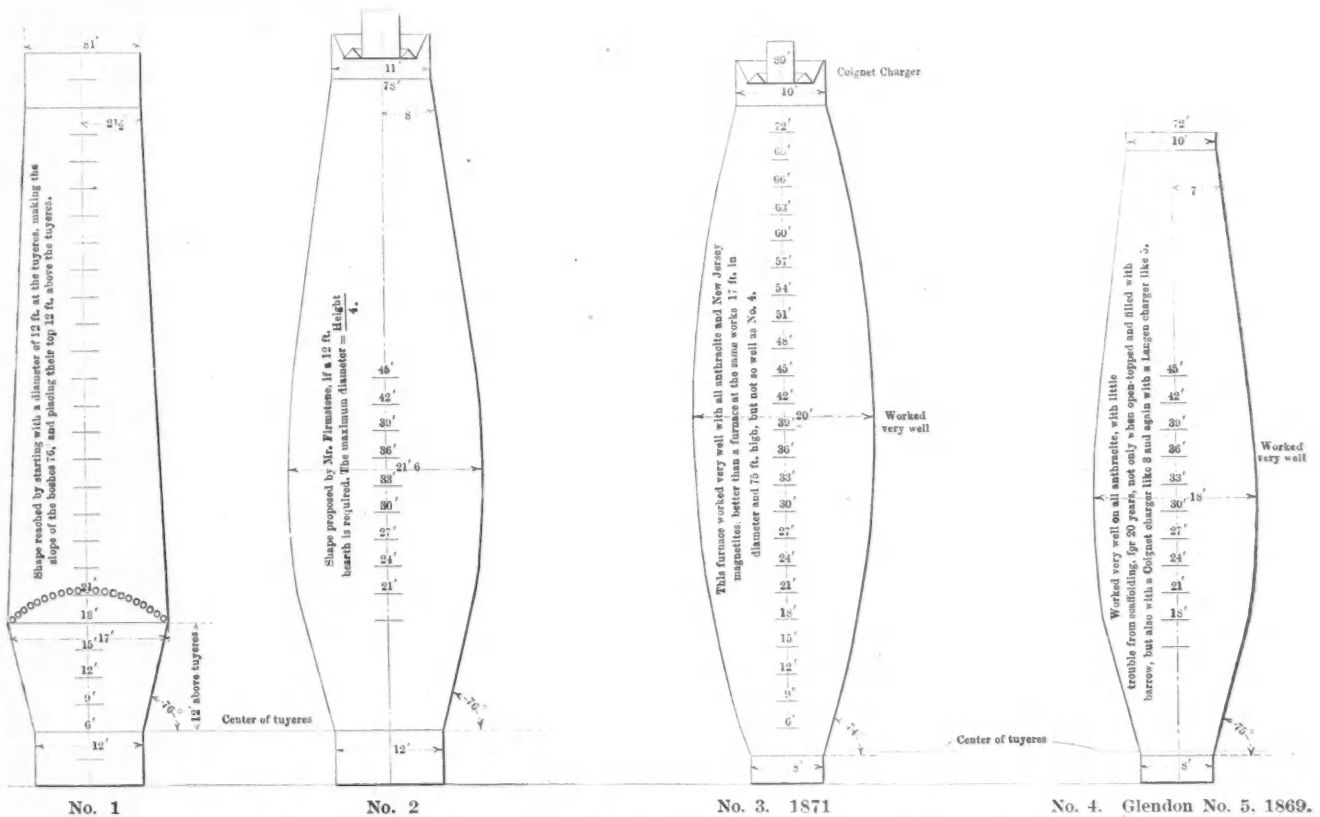


FIG. 3. INSIDE DIMENSIONS OF BLAST FURNACES, SHOWING VARYING FORMS

space below had been emptied. The blast, of course, was off at the time.

Second, in actual running, the lifting action of the blast is actually at work.

Third, the assumed jamming need not be of the arch type; it may be of the dome type. The dome of the Pantheon has a wide opening in its center, as indeed have most domes; yet they do not fall. Indeed, each horizontal course of stones in such a dome may be stable and sustained by itself and the courses outside it, without the aid of the courses inside it. Such a domed jamming, even if confined to a relatively narrow ring next the walls, might cause grave irregularity.

Fourth, "wheat will often arch completely across the ordinary elevator bins."

regular working of a swift-running furnace. Such an extension of the boshes might not create complete or even incipient arches, but yet might impede harmfully a very rapid descent of a very pasty charge.

This is a question to be decided by evidence. The point which this evidence should cover is this: Has it been found practicable to make any furnace of very great output, and running on a very calcareous slag, work regularly and evenly in case the outward flare of the boshes was continued upward past the region of pastiness and incipient fusion?

¹E. P. Goodrich, *Trans. Am. Soc. Civil Engineers*, 60, 1908, p. 61.

THE BATTER FROM THE TOP DOWNWARD

Passing downward from the top, the walls batter outward at an angle between 6 and 9 deg., not only to gain space, but also to ease the descent of the charge, which here is obstructed by the rapid deposition of carbon within the ore by the reaction, $2CO = C + CO_2$, or rather by the swelling of the individual pieces of ore to which this carbon deposition gives rise. Witness the harm done by steepening the upper part of the shaft to 3 deg. in No. 12. To widen the furnace still more rapidly would, of course, still further ease the descent of the solid column, and would still farther increase the room available. But it is feared that a more rapid widening would lead to grave ir-

regularities in the distribution of the rising gases, and through this in the reduction of the ore, with the consequence that some of the ore might reach the bottom of the furnace insufficiently deoxidized. However true this may be, it is hard to believe that the particular angle of batter which is appropriate to the very top of the furnace, is also that most appropriate

THE HEIGHT OF THE FURNACE
 This is limited usually to 100 ft. and probably better to 80 ft. under most conditions, Mr. F. L. Grammer argued against extreme height in his article in *The Iron Trade Review* in February, 1902. The reason for this limit probably lies not so much in any crushing and jamming effect of an excessively high column of solid

flexion shows. The chief purpose in lengthening the furnace is to increase the rate of production. But the chemical needs of the process demand that, for every ton of iron made, a certain quantity of blast shall be blown through the furnace. Hence, if by hightening the furnace we hope to increase its production by, for instance, 25 per cent., we must expect

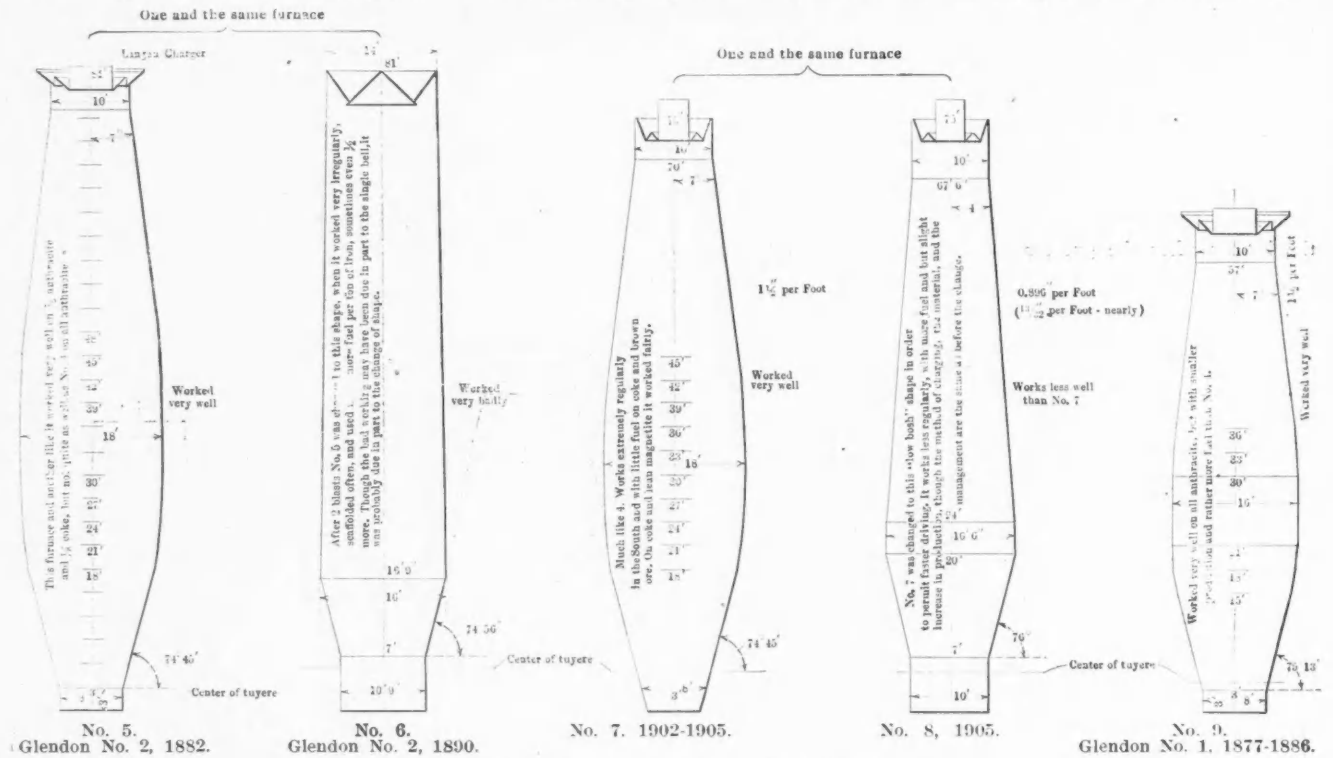


FIG. 4. DIFFERENT FURNACE LINES EMPLOYED IN PRACTICE

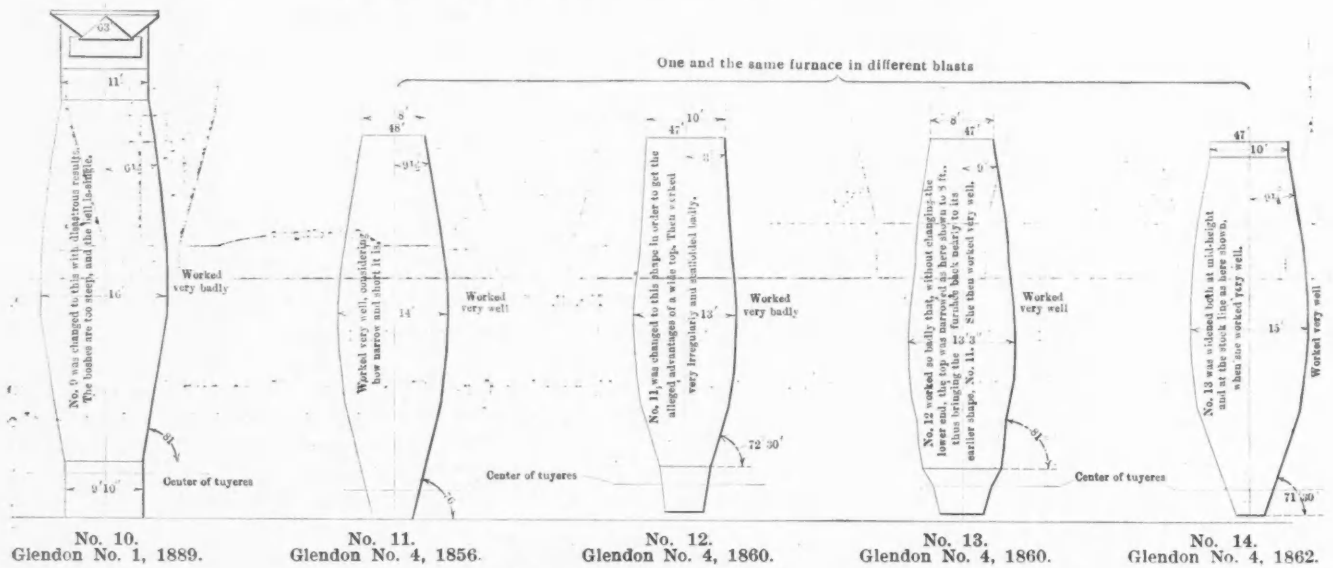


FIG. 5. LINES OF TWO OLD FURNACES AND THE RESULTS IN OPERATION

to each and every level thence downward to the top of the boshes. We naturally expect that this present shape, reached as an early approximation to the best, will later on be improved in the way of making the batter in the several different levels conform to the conditions which exist in each.

materials on the coke in the lower and narrowing end of the furnace, as in the frictional resistance, which even for constant velocity, increases very rapidly with the height of the furnace. But, in order to get the benefit of added height the velocity of the rising gases, instead of being constant, must be increased about proportionally to the height, as the least re-

to blow 25 per cent. more blast through it, and thus to increase the velocity of the rising column of gases by 25 per cent. In short, lengthening the furnace implies increasing the friction in two ways which act cumulatively, (1) lengthening the path through which the rising gases must be forced; and, (2) increasing the already very great speed at which they must be

forced through their most tortuous and narrow passages. The average velocity of the gases rising through a 100-ft. furnace of, say, 32,000 cu. ft. capacity, with 64,000 cu. ft. of air blown through per minute, is probably much greater than 2000 ft. per minute, or that of a "high wind." In places it may rise to 4000 ft. per minute. Conceive, now, these gases moving at this velocity, which is impressive enough when met in the open, through the narrow interstices between adjoining lumps of coke and ore; conceive further that, where these lumps come nearest to each other, at their corners where the salient points on their rough edges actually touch, there is still farther narrowing of these minute spaces through which this inverted gaseous Niagara must tear, and you may get some idea of the energy needed for overcoming the frictional resistance, and indeed of the terrific dynamic conditions inside the peaceful-looking blast furnace.

With this picture in mind, not only the great entrainment of fine ore from rapidly driven high furnaces, but the hangings and slips, readily explain themselves. The frictional lifting effect of the rising gases may at times readily become so great as to interrupt the regular descent of certain parts of the column, for instance those in which the frictional resistance of the solid column to the upward passage of the blast is increased by the swelling of the ore caused by the deposition of carbon within it, and by the denseness, not to say impenetrability, of the column where thus swollen and compacted. Part of this enormous column may thus be suspended like a ball in the rising jet of a fountain, and may later fall with great violence and even with destructive effect when, by some change in the conditions, the friction is lessened. When such a suspended mass once starts downward, its fall becomes ever freer and freer, less and less impeded by the rising gases, because as it descends, between it and the furnace walls an ever widening space for the free upward rush of those gases is given by the outward batter of these walls.

The considerations which have now been presented give the profile of the furnace closely enough for the purpose of this elementary article, by fixing the height, the diameter at top and bottom, and the batter of the boshes and of the upper part of the shaft.

The results already reached with hearths wider than 12½ ft. lead us to hope, as already indicated, that widths much greater than this may be found practicable. The proper distribution of the charge at the top of the furnace is not intrinsically so difficult a thing that it may be expected to baffle indefinitely the attempts to bring about proper distribution over much wider tops than are now used. If we could widen the furnace at top and bottom, then for all we now see we ought to be able to widen it proportionally throughout, and thus to increase its volume and production

very greatly. But the difficulties in the way of increasing the height seem of a different and more insuperable kind. Therefore, we may expect that future increase of production will come rather through increase in width than through lengthening the furnace.

Mr. Firmstone gives us sketches of furnaces 1 to 14, inclusive, which are very valuable additions to our records.

Four points here deserve special notice.

(1) The good working of Nos. 3, 4, 5, 7, 9, 11, 13 and 14 in spite of the outward flare of the boshes being carried, though somewhat steepened, very far above the region of pastiness.

(2) The great harm, as regards regularity, scaffolding and fuel consumption, done by changing from the high bosh of No. 5 to the low bosh of No. 6, and the corresponding, but much less harm done by like changes from No. 6 to No. 8.

(3) The great harm done by the extreme steepening of the boshes, to 81 deg., and substituting a single for a double bell in changing from No. 9 to No. 10.

(4) The great harm done by lessening the batter of the upper part of the shaft to 3 deg. in changing from No. 11 to No. 12, its removal on changing back in No. 13 to a batter of 9 deg., and nearly to the shape of No. 11, and the absence of harm on widening top and mid-diameter without changing the batter of the upper part of the shaft in changing again to No. 14.

Camp Bird, Ltd.

This English company owns and operates a mine at Ouray, Colo. The report for the year ended April 30, 1908, shows the capital stock authorized, £1,100,000; issued, £820,000, in shares of £1 each. In addition to the mines which it operates the company owns 574,830 shares, of \$1 each, in the Imogene Basin Gold Mines Company.

The statement of earnings and expenses, as made in sterling from the London office, is as follows, the averages being based on 80,087 tons dry ore treated in mills. The averages are given in dollars:

| | Total. | Per Ton. |
|---------------------------------|-----------------|-----------------|
| Bullion..... | £355,958 | \$21.334 |
| Concentrates..... | 68,001 | 4.074 |
| Cyanide slag and matte..... | 440 | 0.026 |
| Miscellaneous and interest..... | 1,710 | 0.102 |
| Total receipts..... | £426,109 | \$25.536 |
| Mining and tramming..... | £70,592 | \$4.232 |
| Stamp-mill expenses..... | 19,454 | 1.166 |
| Cyanide mill expenses..... | 10,051 | 0.602 |
| Shipping and selling..... | 23,319 | 1.398 |
| General expenses..... | 24,630 | 1.476 |
| Depreciation, etc..... | 10,333 | 0.618 |
| Total expenses..... | £158,409 | \$9.492 |
| Net earnings..... | £267,700 | \$16.044 |

The expenses are given in much detail. The report is accompanied by a plan and section of the mine.

The income account for the year, condensed, is as follows:

| | |
|------------------------------|-----------------|
| Net earnings, as above..... | £267,700 |
| Interest, exchange, etc..... | 4,051 |
| Total..... | £271,751 |

| | |
|--|---------|
| T. F. Walsh, 25 per cent. of net..... | £69,853 |
| London office, directors' fees, etc..... | 7,682 |
| Reserve for income tax..... | 10,000 |
| Dividends, 20 per cent..... | 164,000 |

Total..... £251,535

Balance to profit and loss..... £20,216

Adding £111,237 forward from previous year, made a total surplus of £131,453 at the end of the year.

The mine report shows a total of 6924 ft. development work done, and 2068 ft. diamond-drill work. During the year there were 48,711 tons of ore broken down in stopes, of which 22,123 tons were delivered to the mills, and 26,588 tons were left in the stopes; 2964 tons of ore were also broken during the course of development work. From the reserves in stopes, 54,425 tons were withdrawn (10,394 tons in excess of the original estimates), making a total delivery to the mills (based on measurements) of 79,512 tons ore (based on mill weights), 79,043 tons dry; 77 tons dry were added to the mill reserve storage bins, making a total of 78,966 tons of dry ore from mine treated in the mills. In addition, there were treated 1121 tons (dry weight) of mixed ore, concentrates, etc., gathered from the wreck of the stamp mill burned in 1906; making the total treated in the mill 80,087 dry tons.

The mill report shows that only nine days were lost during the year by holidays, repairs, etc. Of the gold values in crude ore there was a saving of 93.84 per cent., being 0.09 per cent. greater than for the previous fiscal year, and is a new record in the history of the mill. Of the total value extracted, there was obtained through amalgamation 74.76 per cent., through concentration 16.02 per cent., and through cyanidation 9.22 per cent., of which gold constitutes 94.82 per cent., silver, 3.31 per cent., lead, 1.85 per cent., and copper, 0.02 per cent. The value of metallic contents is as follows: Gold, \$1,963,839; silver, 68,546; lead, \$38,376; copper, \$307; total, \$2,071,068. In the stamp mill there were treated by amalgamation and concentration—the tailings being passed to the cyanide mill—82,574 tons, wet, or 80,087 tons dry ore. There were passed to the cyanide mill 74,072 tons of tailings, from which were separated and treated 49,805 tons, dry weight. The gross recovery in the stamp mill was \$1,880,213; expenses, \$94,935; net, \$1,785,278. In the cyanide mill gross value saved was \$190,854; expenses, \$49,049; leaving \$141,805 net recovery.

The large flow of water has been the cause of an increase in mining expenses. There are now in use pumps having capacity to handle 1000 gal. per minute.

A large barrier of rock has been built above the mill to prevent any recurrence of the damage from snowslides which has occurred in previous years. A geological survey of the mine is now being made by J. E. Spurr, upon the results of which the direction of future development work will depend.

Costs of Mining Quartz Pyrite Gold Deposits

A Study of the Costs of Mining and Milling as Shown in the Reports of Several Profitable Operations in Different Parts of the World

BY JAMES RALPH FINLAY*

Included in the class of quartz pyrite mines are all of the properties of the Witwatersand in the Transvaal, in fact all the gold mines of South Africa, nearly all the mines in eastern Australia, those of the Kolar district in India, of El Oro in Mexico, of California, Nevada and Douglas island, Alaska. In general, these ores are a light-colored or whitish quartz containing from 0.25 to 10 per cent. of iron pyrite and other sulphides in varying but usually subsidiary amounts. The quartz and pyrite may fill open fissures, or they must be replacements of country rock, or the cementing material of beds of conglomerate. Deposits of this kind have proved to be extensive, often persistent to great depths, and are worked on a grand scale.

TREADWELL GROUP

The group of mines on Douglas island, Alaska, known as the Treadwell, Mexican and Ready Bullion, furnish ore for 780 stamps at the rate of 1,200,000 tons a year. This work with good reason stands at the head of the list of quartz-pyrite operations, furnishing an example of the simplest metallurgical problem, the lowest costs, and, I believe, the best management to be found in this class of mining. The external and internal factors which effect the results obtained are of great interest to the student of mine economics.

Robert Kinzie, now superintendent of all the mines, published in *Trans.*, A. I. M. E., Vol. XXXIV, a detailed account of these properties up to 1902; in addition to this we have the full and excellent reports issued by the companies. On the whole the information available is definite and satisfactory.

Along a great porphyry dike which cuts the black slate of Douglas island, there are three or four large lenses or ore-shoots where the dike has been profoundly altered and silicified by the action of magmatic waters. The largest and most northerly of these is the Treadwell orebody, which was 400 ft. wide and 1000 ft. long at the surface. The Mexican and Ready Bullion orebodies are approximately 20 ft. thick and from 500 to 1000 ft. long in horizontal section. These orebodies are situated within a stone's throw of a splendid harbor on a sheltered waterway, which extends for 1000 miles from Puget sound to Skagway. The most convenient and cheapest transportation facilities are thus provided for coal, timber

and other supplies. Concentrates, in the shape of auriferous iron pyrite, are shipped 800 miles to the Tacoma smelter at a cost of \$1.72 per ton. The climate, though rainy, is mild and pleasant, corresponding to that of Scotland or southern Norway. While wages are not low, according to some standards (averaging about 32c. per hour in actual cost), I believe that labor, owing to its efficiency, is really cheap. In addition to these advantages an abundance of water power is available. Little pumping is necessary in the mines. These external factors are so favorable as to be quite exceptional; perhaps unrivaled.

INTERNAL FACTORS

The internal factors are also exceptional. The orebodies are large and firm; standing nearly vertical between pretty solid walls, they come up under the glacial drift in large masses that could be attacked in open pits. The metallurgical problem is the simplest.

Mining these orebodies, therefore, presented to the management the following factors: Several million tons of ore favorably situated for cheap handling, but containing less than \$3 per ton. To make the maximum profit, or to make profits at all, required cheap methods both of mining and milling.

These conditions as to mining were met at the beginning by the "milling" method in an open pit; and as to treatment by the adoption of a large, simple, water-actuated stamp mill in which ore could be amalgamated and concentrated in wholesale quantities and at minimum cost. The simple metallurgical treatment proved amply effective, for the ore is thus treated at a cost of 17 to 27c. a ton with an apparent extraction of 90 per cent.

As the mining proceeded it became increasingly difficult and finally impossible to maintain the required output from open pits and it became again imperative to devise a method of mining, this time underground, that would be cheap enough. It was a broader problem than the first because it involved the question of how much ore could be sacrificed on the one hand and how cheap the mining could be done on the other. It was discovered that about 75 per cent. of the ore could be mined without timbers from large chambers kept full of broken ore, only enough being drawn off at the bottom to afford room for the miners at the top. In the widest deposit this process costs \$1 per

ton and in the narrower bodies \$1.20 per ton.

No change being required in milling methods on account of increasing depth the inauguration of the method of mining described seems to have solved the problem of making these orebodies pay to an indefinite depth as long as they maintain anything like their present size and value.

The milling of the Treadwell ores, its results, the collection and shipment of concentrates are all shown up to 1902 in the accompanying tables given by Mr. Kinzie. It is well to note that in each of the mines the value recovered is about equally divided between free gold saved by amalgamation and auriferous pyrite which constitutes 2 per cent. or less of the original ore. The shipment and treatment of these concentrates costs about \$6.75 a ton and when spread over the original ore milled costs from 10 to 14c. a ton.

The actual results and average costs up to the end of the reports for 1907 for the various mines are as follows:

| | Treadwell. | Mexican. | Ready Bullion. |
|--|------------|-----------|----------------|
| Tons milled. | 8,485,085 | 2,447,063 | 1,841,079 |
| Tons in sight. | 4,982,883 | 794,924 | 1,378,651 |
| Feet development work, 14 years. | 74,717 | 59,960 | 27,362 |
| Tons developed per foot approximate. | 120 | 54 | 100 |
| Total value recovered per ton. | \$2.44 | \$2.55 | \$1.89 |
| Profits, operating, per ton. | 1.16 | 0.77 | 0.25 |
| Total operating cost per ton. | 1.28 | 1.78 | 1.64 |
| Last depreciation figures per ton. | 0.21 | 0.23 | 0.35 |
| Total estimated cost. | 1.49 | 2.01 | 1.99 |

From the above it appears that the Treadwell and Mexican mines have been very profitable, but that the Ready Bullion has not as yet earned enough to justify the investment but the improvement in grade at the bottom is such as to be very promising for the future. It further appears that the combined mines have treated 12,773,227 tons of quartz worth \$30,446,947 or \$2.38 per ton for a total operating cost of \$1.43 per ton, to which is to be added 24c. a ton as a fair estimate (it seems very liberal) of the value of the plants employed; the total to be estimated for cost being \$1.67 per ton and the profit 71c. or 30 per cent. of the gross value recovered.

Below are given, more in detail, the costs of these remarkable mines, for the Treadwell in the year ending May 31, 1907, and for the Mexican and Ready Bullion for the calendar year 1907, the ore

*Consulting mining engineer, 2 Rector street, New York.

ALASKA TREADWELL GOLD-MINING COMPANY.
Receipts and Expenditures in Dollars Per Ton. Also Conditions Affecting Operating Costs.

| Year. | ALL EXPENSES PER TON. | | | PROFITS PER TON. | | | PER CENT. ORE FROM | | | CONCENTRATES. | | | GRAND TOTAL. | Profit. | Year. | Remarks. | | | | | |
|--------|-----------------------|-----------|--------|---|------------|--------|--------------------|--------------|-------------|-------------------------|---------------------------------|--------------|--------------|---------|-------|----------|--------------|-------------------------|--|-----------|----------------|
| | Douglas Island | Supplies. | Labor. | San Francisco, London, Paris and Consulting Engineer. | Operating. | Other. | Surface Pits. | Underground. | Shaft Sunk. | Other Development Work. | Pounds Powder Used Per Ton Ore. | Water Power. | | | | | Steam Power. | Per Cent. Indian Labor. | Average Daily Pay All D. Island Employees. | Per Cent. | Value Per Ton. | Tons Ore Milled. |
| 1890-1 | \$3.49 | \$0.73 | \$0.85 | \$0.13 | \$1.71 | \$0.10 | 100 | 100 | 100 | 1.01 | 79.11 | 20.89 | 20.89 | 4.8 | 3.18 | 2.66 | \$40.65 | 220,686 | \$18,208.90 | 1890-1 | Six months. |
| 1891-2 | 2.95 | 0.65 | 0.78 | 0.07 | 1.50 | 0.08 | 100 | 100 | 100 | 0.93 | 73.29 | 26.71 | 26.71 | 4.8 | 3.18 | 2.40 | 40.42 | 230,686 | \$18,080.90 | 1891-2 | |
| 1892-3 | 2.94 | 0.72 | 0.56 | 0.07 | 1.35 | 0.04 | 100 | 100 | 100 | 0.73 | 70.18 | 29.82 | 29.82 | 4.8 | 3.18 | 2.30 | 40.12 | 237,932 | \$18,612.70 | 1892-3 | |
| 1893-4 | 3.21 | 0.52 | 0.75 | 0.09 | 1.35 | 0.10 | 100 | 100 | 100 | 0.76 | 71.34 | 28.66 | 28.66 | 4.8 | 3.18 | 2.15 | 40.15 | 220,613 | \$18,913.86 | 1893-4 | |
| 1894-5 | 2.60 | 0.59 | 0.71 | 0.07 | 1.37 | 0.06 | 100 | 100 | 100 | 0.60 | 80.36 | 19.64 | 19.64 | 4.8 | 3.18 | 1.71 | 40.52 | 209,613 | \$19,943.86 | 1894-5 | |
| 1895-6 | 2.97 | 0.45 | 0.65 | 0.07 | 1.16 | 0.07 | 100 | 100 | 100 | 0.76 | 74.06 | 25.94 | 25.94 | 4.8 | 3.18 | 1.70 | 41.33 | 242,027 | \$18,967.73 | 1895-6 | |
| 1896-7 | 2.80 | 0.75 | 0.75 | 0.08 | 1.57 | 0.11 | 100 | 100 | 100 | 0.84 | 62.73 | 37.27 | 37.27 | 4.8 | 3.18 | 1.76 | 48.11 | 254,329 | \$18,260.82 | 1896-7 | |
| 1897-8 | 2.71 | 0.48 | 0.72 | 0.07 | 1.28 | 0.12 | 100 | 100 | 100 | 0.80 | 58.40 | 41.60 | 41.60 | 4.8 | 3.18 | 1.76 | 48.78 | 250,408 | \$18,792.31 | 1897-8 | |
| 1898-9 | 2.07 | 0.44 | 0.45 | 0.03 | 1.15 | 0.06 | 100 | 100 | 100 | 0.80 | 72.37 | 27.63 | 27.63 | 4.8 | 3.18 | 1.76 | 41.92 | 527,900 | \$18,961.18 | 1898-9 | |
| 1899-0 | 1.88 | 0.54 | 0.62 | 0.01 | 1.19 | 0.08 | 100 | 100 | 100 | 1.43 | 54.33 | 45.67 | 45.67 | 4.8 | 3.18 | 1.78 | 41.92 | 457,802 | \$18,558.89 | 1899-0 | |
| 1900-1 | 1.91 | 0.49 | 0.78 | 0.01 | 1.28 | 0.05 | 100 | 100 | 100 | 1.43 | 54.33 | 45.67 | 45.67 | 4.8 | 3.18 | 1.82 | 56.48 | 682,893 | \$18,558.89 | 1900-1 | |
| 1901-2 | 1.88 | 0.46 | 0.54 | 0.01 | 1.01 | 0.05 | 100 | 100 | 100 | 1.43 | 54.33 | 45.67 | 45.67 | 4.8 | 3.18 | 1.88 | 49.79 | 508,636 | \$18,513.32 | 1901-2 | |

ALASKA UNITED GOLD-MINING COMPANY—READY BULLION MINE.
Receipts and Expenditures in Dollars Per Ton. Also Conditions Affecting Operating Costs.

| Year. | ALL EXPENSES PER TON. | | | PROFITS PER TON. | | | PER CENT. ORE FROM | | | CONCENTRATES. | | | GRAND TOTAL. | Profit. | Year Ending Dec. 15. | | | | | |
|-------|-----------------------|-----------|--------|---|------------|--------|--------------------|--------------|-------------|-------------------------|---------------------------------|--------------|--------------|---------|----------------------|--------------|-------------------------|--|-------------|----------------|
| | Douglas Island | Supplies. | Labor. | San Francisco, London, Paris and Consulting Engineer. | Operating. | Other. | Surface Pits. | Underground. | Shaft Sunk. | Other Development Work. | Pounds Powder Used Per Ton Ore. | Water Power. | | | | Steam Power. | Per Cent. Indian Labor. | Average Daily Pay All D. Island Employees. | Per Cent. | Value Per Ton. | Tons Ore Milled. |
| 1898 | 2.42 | \$0.71 | \$0.55 | \$0.03 | \$1.29 | \$1.13 | 100 | 100 | 100 | 2.69 | 2112 | 602 | 602 | 4.8 | 3.18 | 2.03 | \$72.00 | 19,612 | \$13,412.12 | 1898 |
| 1899 | 2.72 | 0.90 | 1.04 | 0.03 | 1.04 | 0.75 | 100 | 100 | 100 | 4.27 | 4272 | 47 | 47 | 4.8 | 3.18 | 1.93 | 38.10 | 162,107 | \$12,333.75 | 1899 |
| 1900 | 2.15 | 0.78 | 0.83 | 0.03 | 1.67 | 0.48 | 100 | 100 | 100 | 2.50 | 3552 | 250 | 250 | 4.8 | 3.18 | 2.07 | 31.37 | 170,410 | \$8,418.18 | 1900 |
| 1901 | 1.94 | 0.88 | 0.90 | 0.03 | 1.86 | 0.08 | 100 | 100 | 100 | 1.65 | 2370 | 165 | 165 | 4.8 | 3.18 | 1.97 | 33.14 | 144,612 | \$14,476.01 | 1901 |
| 1902 | 1.48 | 0.70 | 0.78 | 0.02 | 1.56 | 0.02 | 100 | 100 | 100 | 58 | 2787 | 58 | 58 | 4.8 | 3.18 | 2.04 | 32.95 | 226,522 | \$13,385.70 | 1902 |

700-FOOT CLAIM.

| | | | | | | | | | | | | | | | | | | | | |
|------|------|--------|--------|--------|--------|--------|-----|-----|-----|------|------|-----|-----|-----|------|------|-------|---------|-------------|------|
| 1899 | 1.72 | \$0.54 | \$1.10 | \$0.03 | \$1.68 | \$0.04 | 100 | 100 | 100 | 1.11 | 1621 | 72 | 72 | 4.8 | 3.18 | 1.87 | 33.04 | 87,87 | \$5,065 | 1899 |
| 1900 | 1.81 | 0.69 | 0.84 | 0.03 | 1.97 | 0.25 | 100 | 100 | 100 | 1.03 | 1486 | 72 | 72 | 4.8 | 3.18 | 1.87 | 31.01 | 126,410 | \$3,471.05 | 1900 |
| 1901 | 1.97 | 0.90 | 1.05 | 0.03 | 1.97 | 0.48 | 100 | 100 | 100 | 1.23 | 1306 | 812 | 812 | 4.8 | 3.18 | 1.82 | 28.13 | 84,410 | \$2,707.40 | 1901 |
| 1902 | 1.33 | 0.52 | 0.63 | 0.02 | 1.17 | 0.16 | 100 | 100 | 100 | 0.78 | 382 | ... | ... | 4.8 | 3.18 | 1.84 | 28.40 | 118,541 | \$19,262.61 | 1902 |

These costs are much higher than those of the Liberty Bell mine a few miles away. The reason undoubtedly is the higher grade of the Camp Bird ores; this accounts for higher costs in taxes, freight and treatment, etc., and furnishes the excuse for pretty liberal fees and management.

RESULTS OF OPERATIONS AT THE LIBERTY BELL MINE.

| | |
|-----------------------------|---------|
| Tons mined and milled..... | 510,729 |
| Net receipts per ton..... | \$7.20 |
| Costs: | |
| General expense..... | \$1.05 |
| Mining and development..... | 2.65 |
| Tramming to mill..... | 0.42 |
| Milling..... | 1.70 |
| Shipping concentrates..... | 0.36 |
| Total operating..... | \$6.34 |
| Depreciation..... | 0.30 |
| Total..... | \$6.64 |
| Profit per ton..... | 0.56 |

At this mine 26,446 ft. of opening work has been done in nine years, resulting in mining and developing about 900,000 tons of ore, or 34 tons to 1 ft. The cost per foot of development seems to be about \$10, and per ton developed, \$0.30. The stoping width is about 5 feet.

Analyzing roughly the difference between the costs of the Camp Bird and the Liberty Bell it appears that the former is more expensive, as follows:

| | |
|----------------------------|---------------|
| Underground cost..... | \$1.46 a ton. |
| Milling..... | 0.15 |
| Treatment charges..... | 1.45 |
| General expense..... | 2.00 |
| Depreciation of plant..... | 0.55 |
| Total..... | \$5.61 |

It may be fairly said that the higher cost at the Camp Bird for milling and treatment charges are entirely justified by the higher grade of the ore. As to other expenses one may doubt their necessity.

Other mines in the San Juan region whose reports are available are the Tomboy and the Smuggler Union. I have not investigated these reports, but in a general way the costs at these mines are not greatly different from those of the Liberty Bell. These mines have each reported costs lower than those given, for a single year, but it is doubtful if they would be lower if figured upon a long term of years.

In general mining in the San Juan region costs about \$7 a ton. The external factors of a rough surface, a severe climate, costly transportation and a debilitating altitude are all unfavorable. The internal factors are such that only a small tonnage can be maintained. Metallurgically the ores are only fair, and while not markedly difficult, do not seem to permit of full treatment at a cost of less than \$2 a ton. The explanation, therefore, of the big jump in costs from \$1.50 at the Treadwell and \$3 at the Homestake to \$7 in the San Juan is the cumulative effect of a variety of both external and internal factors.

EL ORO, MEXICO

The mines at El Oro, Mexico, are well

managed; they pay good dividends and issue good reports. The two principal mines are the Esperanza and El Oro on the San Rafael vein and the Dos Estrellas on a parallel vein to the westward. The Mexico mine just north of the Esperanza on the San Rafael lode is promising. The veins are large mineralized shear zones in slate or shale. There are numerous cross faults. The veins are for the most part obscured by a later flow of andesitic lava which covers the important orebodies to a depth of several hundred feet. The ore is quartz with pyrite sprinkled through it. The gold is very finely divided, and will yield by amalgamation only about 15 per cent.

The external conditions are probably about average for gold mining. The wages for natives are low and their labor inefficient. Water-generated electric power is furnished to the mine. The El Oro company owns a railroad, timber lands and a sawmill, and presumably supplies the other mines as well as its own, with timber and transportation.

The walls are heavy, and where broken by cross-faults become very soft. Ordinarily the square-set rooms can be kept open to a height of 40 to 50 ft.; then they must be filled. The mines are pretty hot. The ore while forming in good-sized bodies is separated into streaks in different parts of the shear zone. The development of these requires considerable cross-cutting and drifting along the intersected streaks. Work is also done on entirely distinct veins separated by some hundreds of feet of waste. The experience to date has shown the requirements in the way of development to be as follows:

| | Feet. | Tons Mined. | Tons Developed. |
|----------------|---------|-------------|-----------------|
| El Oro..... | 88,803 | 820,000 | 605,000 |
| Esperanza..... | 60,640 | 875,000 | 142,000 |
| Total..... | 149,440 | 1,695,000 | 747,000 |

About one foot of opening work to 16 tons discovered.

COSTS.

| | El Oro. | Esperanza. |
|-------------------|-----------|------------|
| Tons mined..... | 1,080,788 | 450,000 |
| Tons milled..... | 1,027,282 | 333,330 |
| Mining..... | \$1.99 | \$2.80 |
| Development..... | 0.74 | 0.80 |
| Milling..... | 0.77 | 2.63 |
| Cyaniding..... | 1.11 | |
| Water..... | 0.02 | |
| Other..... | 0.13 | |
| General..... | 0.90 | 1.08 |
| Construction..... | 0.36 | 0.19 |
| Total..... | \$6.02 | \$7.50 |

The Esperanza produces other higher-grade ores that are not cyanided. These ores are either concentrated and the concentrates smelted, or shipped directly to the smelters. Ores shipped direct have paid for freight, treatment and shipping expense about \$18.75 per ton.

The recovery of metals at the two mines is reported for 1906-7 as follows:

| | Gold, Per Cent. | Silver, Per Cent. | Total Value, Per Cent. |
|----------------|-----------------|-------------------|------------------------|
| Esperanza..... | 90.64 | 57.33 | 86.20 |
| El Oro..... | 90.28 | 68.55 | 86.63 |

Costs at the Esperanza have always been higher than at the El Oro both for mining and milling. There is nothing in the reports to explain why this should be so.

KOLAR DISTRICT, MYSORE, INDIA

In Vol. XXXIII, Part 1, of the "Memoirs of the Geological Survey of India," F. H. Hatch gives an excellent practical description of the Kolar mines as they were in 1900. Since that time certain changes have been introduced, notably water-generated electric power; the scale of operating has increased and the costs diminished, but no specific description of these changes has come to my attention. The reports of the various companies give abundant information about output, costs, mine developments, etc. It is possible that something might be changed by Mr. Hatch if the descriptions were to be brought down to the present day, but on the whole the sources of information are satisfactory. One feels particularly like complimenting Messrs. John Taylor & Sons, who manage most of the mines, on their complete and detailed annual reports to their stockholders.

The principal mines are the Mysore, Champion Reef, Ooregum and Nundydroog; other mines are not very profitable. The district has been opened since 1882. The output has been steadily increasing, but the maximum seems to have been reached. The climate is tropical; the rainfall averages 30.13 in. per year, but is variable.

This Indian gold-field is one of the most instructive examples to be found anywhere in studying the basic principles of mine economics. The center of the field is 183 miles from the important seaports of Madras; the freight rate for various articles being as follows (presumably per long ton):

| | |
|---|---------|
| Coal in carloads..... | \$ 1.40 |
| Timber less than 17 ft. long..... | 1.90 |
| Timber more than 17 ft. long..... | 2.24 |
| Steel, cast iron pipes, machinery and kerosene..... | 3.40 |
| Wire ropes and galvanized iron pipes..... | 4.45 |
| Machinery in small lots..... | 5.87 |
| Explosives..... | 16.67 |

Indian coal is delivered at the mines for \$6.50 per ton; English coal for \$9.75 and fire wood for \$2.56. Ordinary mining timber costs from \$20 to \$45 per M., a large proportion being of the more expensive kinds. Dynamite costs about 27c. per lb. and blasting gelatin (93 per cent. nitro glycerin) 35c. These supplies, it will be observed, are all more expensive than in the United States in the proportion of perhaps two to one.

LABOR AT MYSORE

When we come to labor the situation is interesting. Men are employed in the following proportions:

| | |
|----------------|----------------|
| Europeans..... | |
| Eurasians..... | 1.6 per cent. |
| Natives..... | 96.2 per cent. |

I have no means of computing the average wages earned by three classes. Europeans are paid by the month, on contract usually for three years. Transportation is provided by the companies to and from Europe, and quarters, furniture, fuel, lights and servants also. Men laid up by sickness draw full pay. The salaries vary from \$30 a month for some of the miners to \$100 for smiths and machinists and \$250 to the highest paid chemists and foremen. Considering the debilitating effect of the climate and the loss of time during illness, voyages and holidays, it does not seem improbable that the work done by these men costs at least twice as much as work done in the United States would cost if done by men paid the same wages. Indeed I believe this estimate is too low.

Wages of natives are as follows:

| | |
|----------------------|------------|
| Carpenters..... | 12 to 50c. |
| Smiths..... | 8 to 48c. |
| Timbermen..... | 16 to 43c. |
| Engine drivers..... | 20 to 33c. |
| Trackmen..... | 20 to 41c. |
| Gang bosses..... | 24 to 33c. |
| Machine men..... | 20 to 33c. |
| Hand miners..... | 16 to 24c. |
| Blasters..... | 16 to 24c. |
| Landers..... | 16 to 20c. |
| Trammers..... | 16 to 18c. |
| Muckers..... | 14 to 16c. |
| Firemen..... | 12 to 16c. |
| Surface coolies..... | 8 to 12c. |

OPERATIONS OF THE PRINCIPAL MINES IN THE MYSORE DISTRICT, END OF 1906.

| Mine. | Tons Milled. | Value. | Dividends, Cash. | Profit, Per Cent. | Cost, Per Cent. |
|--------------------|--------------|-------------|---------------------|----------------------|--------------------|
| Nundydroog..... | 699,730 | £2,732,000 | £1,317,000 | 48.2 | 51.8 |
| Ooregum..... | 1,236,812 | 4,258,000 | 1,514,000 | 35.5 | 64.5 |
| Mysore..... | 1,817,451 | 9,117,000 | 5,156,000 | 56.4 | 43.6 |
| Champion Reef..... | 1,730,677 | 7,796,000 | 3,647,000 | 47.0 | 53.0 |
| Total..... | 5,484,670 | £23,903,000 | £11,634,000 | 48.7 | 51.3 |

It is, of course, impossible to obtain from these details an exact estimate of the wages paid, but on the assumption that the wages of miners are somewhere near the average for natives and that Europeans average \$5 a day including expenses and Eurasians \$2 we have:

| | |
|------------------------------------|---------|
| 2.2 Europeans at \$5 equals..... | \$11.00 |
| 1.6 Eurasians at \$2 equals..... | 3.20 |
| 96.2 Natives at \$0.23 equals..... | 22.12 |
| 100.0 | \$35.32 |

This means an average wage of 36c., or thereabouts for all employees.

FACTORS IN MINING

The internal factors are a single marvelously persistent quartz vein, with a few branches, developed for a length of 17,500 ft. The vein occurs in a belt of schists which I suppose, from the presence of beds of quartzite, are undoubtedly in part metamorphosed sediments. The belt seems to be a syncline, but it is invaded on both sides by intrusive granites. The bulk of the schist consists of altered traps or lavas. There are some later dikes of a basic character. The vein corresponds both in strike and dip, which is about 50 to 55 deg. west, with the foliation of the schists. The ore is a clean quartz containing 0.25 per cent. of pyrite. The quartz occurs in a number of shoots along

the vein. Some of the shoots occur in sharp anticlinal folds where something like the saddle reefs of Bendigo, Australia, has been developed in the vein. The direction of other ore shoots along the plane of the vein seems to be about parallel to the axes of these folds. The extent of the shoots is variable; some of the largest are known to be more than 4000 ft. deep along the slope, and as much as 800 ft. wide, measured at right angles to the long axis. It is difficult to ascertain the thickness of the vein stoped; the average is probably between 3 and 4 ft. Taking the vein at large, the poor with the good, the average thickness of mill ore developed on the Mysore property in 1907 was 1.8 feet.

Although these mines, particularly the Mysore, are looking exceedingly well in the bottom, the thickness and grade of the ore show some diminution. The greatest vertical depth reached is about 2400 ft. in the Edgar shaft of the Mysore. In earlier years, when the mines were less than 1000 ft. deep, vertically, the ore shoots on the Mysore and Champion Reef mines seem to have averaged nearly 5 ft. in thickness.

METHOD OF TREATMENT

The milling practice is simple. The ore, when properly sorted, yields a clean quartz with very little clayey matter in it. The process consists of amalgamation in a stamp battery followed by cyaniding the tailings. A special cyanide process is used for the comparatively small proportion of slimes. The only distinctive fact is that the crushing duty per stamp is low, being only 2.25 tons per day per 1050-lb. stamp. The pulp is put through screens averaging about 1600 apertures per sq.in. The low stamp duty is made necessary by the high grade of the ore. In the Transvaal and at the Treadwell, the duty per day is about five tons per stamp.

A few years ago a striking and uneconomical feature of the metallurgical practice was that the work was done in a number of small mills instead of in a central large one on each property. This bad feature has been, I believe, largely corrected.

VALUE AND COSTS PER TON.

| | Value. | Profit. | Cost. |
|--------------------|---------|---------|--------|
| Nundydroog..... | \$19.03 | \$ 9.21 | \$9.82 |
| Ooregum..... | 16.79 | 5.96 | 10.83 |
| Mysore..... | 24.48 | 13.81 | 10.63 |
| Champion Reef..... | 21.98 | 10.33 | 11.65 |
| Average..... | 21.28 | 10.36 | 10.92 |

These figures are not far from the

real performance of the mines for the period, although they are in error in two respects on different sides of the account. On the one hand the costs include the royalty paid to the Mysore government. This royalty is, of course, an operating profit, although it takes the place of taxes which invariably constitute an important cost item. On the other hand the profits include the proceeds of a considerable amount of shares issued for improvements and sold at high premiums.

A QUESTION OF BOOKKEEPING

To charge improvements to capital account, even if they are absolutely new, is a bookkeeping error into which nearly all mining companies fall. This error is, of course, in most cases theoretically rectified by writing off a certain amount for depreciation. While in the case of these Kolar mines it appears that the depreciation has kept pace with the increase of capital (for 11 years the Mysore company received from stockholders about £60,000 a year), this does not alter the fact that the money thus written off did not come out of the mine. To some extent, of course, the money thus provided was used to make a real increase in the company's resources, and to this extent it will be paid back in the shape of increased profits, or lower costs, in later years. But it should never be forgotten for a moment that there is always some work going on about a mine in the shape of permanent improvements and that for a period of years the average amount thus expended should not be written off the balance sheet; it should be charged to operating. To pay operating expenses out of new capital is either a fraud or a bookkeeping sophistry. It is always a mistake more or less complete. It may be partly justified but never wholly.

The accompanying table prepared by Mr. Hatch shows the distribution of costs for the year 1899. These costs are a little higher than the average, but not so much as to give a seriously false impression.

Within the past year or two considerable economy has been effected by the introduction of water-generated electric power from the Cavvery falls. In 1899 steam power cost \$150 per horsepower year and the cost per ton for the power used was more than \$3. Electric power is now furnished for \$90 a year, reducing the power cost more than \$1 per ton.

I will not go into details regarding all the mines, but will give some facts regarding the Mysore, the largest and best mine in the district. This property in the years 1902-1907, inclusive, did 163,691 ft. of development work, mined and milled 1,080,464 tons of ore, and increased its reserves from 340,000 tons to 904,139 tons. The actual ore developed during the period was 1,644,603 tons, being a trifle more than 10 tons per foot of develop-

ment work. This development with approximate costs was made up as follows:

| | |
|---|--------------------|
| Drifts and crosscuts, 117,912 ft. at \$10 equals..... | \$1,179,120 |
| Raises, 24,041 ft. at \$40 equals..... | 960,000 |
| Winzes, 12,291 ft. at \$40 equals..... | 490,000 |
| Shafts, 9,447 ft. at \$100 equals..... | 944,700 |
| Total..... | \$3,574,000 |

The costs are approximations from Hatch's report.

ciation, this being the average for the last six years. With this addition the total cost is \$10.93. This, it will be observed, is very close, both to Mr. Hatch's figures in 1899, and to my own estimate based on the output and dividends.

Mr. Hatch comments as follows: "The working costs are high, but there

the cyanide process is relied upon to catch the gold that escapes amalgamation. Whereas with high-grade ore the usual practice is to crush fine, and to catch as high a percentage of the gold as possible by amalgamation.

"For these reasons it is impossible to compare the working costs of high-grade mines, such as those at Kolar, with the low-grade mines of other countries, as for instance, those of the Witwatersrand in the Transvaal. At the same time, it must be admitted that a reduction in working expenses at Kolar could no doubt be effected by improvements in milling plant, and by the substitution of automatic mechanical means for native labor in the handling of the ore delivered at the shaft top, and of the tailings leaving the mill. The situation of a large centrally placed mill

COSTS AT THE MINES OF MYSORE IN 1899, ACCORDING TO HATCH.

| | Mysore. | Champion Reef. | Ooregum. | Nundydroog. | Balaghat. | Coronadel. |
|--------------------------|----------------|----------------|----------------|----------------|----------------|---------------|
| Mine costs..... | \$5.79 | \$7.15 | | \$7.02 | \$12.12 | \$4.87 |
| Mill..... | 1.28 | 1.68 | | 1.41 | 1.41 | 1.60 |
| Wheeler pans..... | | 0.69 | \$9.46 | 0.21 | | |
| Cyanide..... | 0.69 | 0.89 | | 0.75 | 0.50 | 0.47 |
| Administration..... | 0.28 | 0.27 | 0.44 | 0.51 | 0.79 | 0.76 |
| General charges..... | 0.75 | 0.61 | 0.49 | 0.48 | 0.31 | 0.49 |
| Total..... | \$8.79 | \$11.29 | \$10.39 | \$10.38 | \$15.13 | \$8.19 |
| Royalty on gold ore..... | 1.58 | 1.51 | 0.86 | 1.12 | 0.63 | 0.21 |
| Depreciation..... | 0.41 | 0.26 | 0.14 | 0.40 | 2.20 | 0.50 |
| London office..... | 0.39 | 0.30 | 0.33 | 0.65 | 0.88 | 0.74 |
| Grand total..... | \$11.17 | \$13.36 | \$11.72 | \$12.55 | \$18.84 | \$9.64 |

COST OF RAISING (10x5 FT.) 15.6 FT. PER MONTH.

| | |
|---------------------|----------------|
| Labor, white..... | \$8.25 |
| Labor, native..... | 4.50 |
| Explosives..... | 6.25 |
| Supplies..... | 4.90 |
| Compressed air..... | 21.00 |
| Total..... | \$44.90 |

COST OF DRIVING.

| | |
|--------------|--|
| Hand..... | \$9 per ft., rate 15 ft. per month. |
| Machine..... | \$11 per ft., rate 30 to 35 ft. per month. |

Stoping in 4½-ft. vein without timbering costs about \$1.25 per ton.

Equivalent work in the United States may be estimated as follows:

| | |
|---|---------|
| Sinking large working shafts (Lake Superior, Butte, Coeur d'Alene, or Cripple Creek), average rate per month 50 ft., cost per ft..... | \$100 |
| Raising with complete timbering, 10x6 ft. Drifting in average ground, 5x8 ft..... | 25 9 |

HIGH DEVELOPMENT COST

If these costs are anywhere near the actual, and I believe that they are, we have an average cost per ton developed of about \$2.10, and per ton milled of \$3.30.

In the abstract of Hatch's figures for various kinds of work is to be observed that the development accounts for about half the cost of mining. In this connection, however, it is well to point out that a considerable portion of the development work does not appear in the working costs, but is charged to capital account. The only place where this expenditure appears is in the balance sheet where certain sums are "written off" for depreciation, etc. These sums amount in six years to \$2,122,000 on machinery, plant, etc. Of this a good deal must represent the cost and equipment of Edgar's and other shafts.

To show how this bookkeeping works, let us take the revenue account for the year 1907. Here we find that administration and working costs including directors' fees, insurance and all general expenses amount to \$8.96 per ton. To this we must add from the balance sheet in order to get the management's real estimate of the costs, the sum of \$1.97 per ton for depre-

COST PER FOOT OF SHAFT-SINKING IN KOLAR GOLDFIELDS.

| | Nundydroog 12 x 6 ft. | Oakleys' 16 x 8 ft. | Champion Reef 16 x 8 ft. | Edgar's Mysore circ'r 18 ft. |
|------------------------------|-----------------------|---------------------|--------------------------|------------------------------|
| Labor..... | \$31.27 | \$32.68 | | |
| Timber..... | 7.88 | 25.22 | | |
| Explosives and supplies..... | 13.40 | 24.20 | | |
| Compressed air..... | 32.84 | 33.88 | | |
| Hoisting..... | 10.93 | 4.84 | | |
| Drill sharpening..... | 0.49 | | | |
| Speed per month..... | \$96.81 | \$120.82 | \$145.91 | \$120 |
| | 15 ft. | 25 ft. | 28 ft. | 20 ft. |

is not much difficulty in accounting for this. First, the nature of the ore-deposit dictates a high cost of working, as, for instance, the occurrence of the pay-ore in shoots, which, though of high grade, are of comparatively limited extent. This leads to a heavy expenditure in development, as much sinking, driving and cross-cutting must be done in waste rock in order to open up pay or shoot ore. The cost of this development work is included in the figures given for working costs. Then again the heaviness or instability of the ground in parts of the mines necessitates a big expenditure on timber to secure the stopes, shafts, and levels.

COSTS AND GRADE OF ORE

"Further it must not be forgotten that the cost of working a high-grade ore is of necessity greater than that of a low-grade ore, and the reason for this is plain. In mining low-grade stuff, the main object is to obtain a large tonnage at a low cost; consequently the stopes are carried as wide as possible and the whole mass of the orebody is, as a rule, exploited, the exploratory or dead work being at a minimum. With high-grade stuff, on the other hand, the stopes are kept as narrow as possible, and great care is exercised only to extract the payable portions of the orebody. Much exploratory work on waste rock is, therefore, necessary in order to locate the pay ore. Similar factors influence the metallurgical treatment. With low-grade stuff the ore is passed quickly through the mill, a high stamp duty being maintained by the use of coarse screening and a low discharge, and

with heavy stamps for several small and scattered mills with light stamps, which at the present moment is being carried out on the Champion Reef, and is in anticipation at Ooregum, will decrease the cost of milling at these mines. The introduction of mechanical haulage, automatic sorting tables, tailings, wheels for elevating the tailings, and pointed boxes for classifying and filling directly into the cyanide vats, all these improvements would no doubt have a similar effect. So also will the introduction of water power transmitted by electric current, as it is proposed to do by the Cauvery power scheme."

WAGES AND COST OF LABOR

I have given many details about the Kolar mines because I wish to illustrate the extraordinary lack of correspondence between the wages paid and the costs. There does not seem to be any detail in which work at these mines is done cheaper than in the United States. In Cripple Creek, or Butte or the Coeur d'Alene where wages average ten times as high as at Kolar work can be done just as cheaply. This is true of drifting, of crosscutting, of raising, of shaft sinking, of stoping, of everything on which I can find data for comparison.

It is true that supplies cost more than in the United States; nevertheless out of working costs of \$8.96 per ton I find that labor must account for about \$5.50 or 60 per cent. This is the usual proportion in the United States. We find that the number of men employed to mine and mill 194,830 tons of rock in 1907 at the Mysore mine was 8334 or 23 tons per man per

year. At the Camp Bird mine in Colorado, where external conditions are unfavorable, the ore being of the same grade and the costs nearly the same, the wages are ten times as high and the output per man ten times as great.

It is inconceivable to me that the energy expended by a miner in Colorado is ten times as great as that expended by the Indian miner. The true explanation of the wonderful difference in performance lies in the industrial efficiency of the community by which the men are surrounded. This is a broad subject, and I do not intend to go into it here further than to point out these mines as an excellent illustration of an economic fact, i. e., that wages have very little to do with costs; that you get what you pay for throughout the world. As Lord Brassey put it, "It costs as much to move a yard of earth in one place as in another."

The Cobalt Silver District, Ontario, Canada

BY WILLIAM B. PHILLIPS*

The local correspondent of the *Toronto World* gives in the issue of that paper of June 28 a list of the mines of the Cobalt district and shipments from January 1 to June 1, 1908, as follows: La Rose, 1515 tons; O'Brien, 1230; Nipissing, 851; McKinley Darragh, 689; Tretheway, 497; Silver Queen, 322; Buffalo (high grade and concentrates), 304; Coniagas (high grade and concentrates), 255; Temiskaming & Hudson Bay, 223; Kerr Lake (high grade), 195; Watts (King Edward group), 184; City of Cobalt, 166; Temiskaming, 132; Cobalt Lake, 123; Right of Way, 119; Nova Scotia, 113; Silver Leaf, 98; Cobalt Central (concentrates 3500 oz.), 98; Foster, 89; Provincial, 75; Drummund, 74; Nancy Helen, 69; Town Site, 68; Silver Cliff, 26; Crown Reserve (very rich ore), 20; Miscellaneous car to smelters, 20 tons or a total of 7516 tons.

This is practically a gain of 3000 tons as compared with shipments during the corresponding period of 1907. The total shipments from the district since 1904 appear to be as follows:

| | Tons. | Value. |
|-------------------------------|--------|--------------|
| 1904..... | 158 | \$136,218 |
| 1905..... | 2,144 | 1,468,524 |
| 1906..... | 5,335 | 3,764,113 |
| 1907..... | 14,040 | 6,020,649 |
| 1908 (first five months)..... | 7,516 | 4,509,600 |
| Total..... | 29,193 | \$15,899,204 |

The value of the ore shipped during the first five months of 1908 is in the absence of official statements taken at \$600 a ton. In 1904 the average value per ton was \$862; in 1905, \$685; in 1906, \$705; in 1907, \$428. The average value per ton for the four years ending with 1907 is \$670.

*Mining engineer and metallurgist, Birmingham, Ala.

Practically all the value of the ore is in the native silver, for while cobalt, arsenic and nickel may be and generally are present the value of these, as compared with that of the silver, is not very great.

It is doubtful if the value of any 29,000 tons of silver ore from any district in the world is anything like as great as that of the ore shipped from the Cobalt district during the last 4½ years. Several carloads of more than \$100,000 a car have been shipped and in one case the total value was not far from \$150,000. These figures show that silver ores of very unusual character are found in this relatively small camp, which has produced during the 4½ years of its existence at a rate of \$9863 a day.

THE FUTURE OF COBALT

What is to be the future of the district? Allowing that the present production is at the rate of \$10,000,000 a year, may it reasonably be expected that the mines now in operation and others that may be added to the list will continue to turn out the metal at this rate? Intimately connected with this question are considerations affecting the security of investments already made and to be made. I do not speak of profits based on stock movements, but of legitimate mining enterprises, designed with care and carried out upon sound business principles. There are such enterprises here as elsewhere.

It seems to me that continued success in the production of silver depends not so much upon the discovery and exploitation of the very rich deposits as upon the possibility of extracting from the ores all of their value. Disregarding the arsenic, cobalt, nickel, etc., there has been a great waste in silver. Even now the smelters do not care to take ore containing less than 100 oz. silver per ton, and it is more than likely that the tonnage of material mined with less than this amount is far in excess of that of the richer ore. With the exception of two or three plants no attempt is made to concentrate the ore other than by hand picking. There are two, perhaps three, modern concentrating plants attached to the regular mining companies, and I understand that they are doing satisfactory work, the Coniagas mill in particular.

With these few exceptions the companies are confining their attention to such ore as can be shipped direct, and to such as can be cobbled up to a high grade. The veins are thin but some of them are extremely rich, and mining in the district has been almost entirely confined to the search for and the development of these thin veins of high value. The operations around Cobalt lake, Cross lake, Peterson lake and Kerr lake have been devoted almost exclusively to high-grade material without regard to milling and concentrating.

Some of the companies, however, are beginning to realize that the high-grade

ore, i. e., such as can be shipped direct or brought up by hand-cobbing, is not the only source of profit. In many of the mines the wall rock is shot through with particles of silver for a distance of 2 to 5 ft. from the main calcite veins and the assays run to \$20 a ton and upwards. In the wall rock the silver appears for the most part to be closely associated with small calcite stringers, but there are some cases in which the calcite is absent and there is no apparent connection between the main silver-bearing veins and the impregnation of the wall rock. All of this material should be milled and concentrated.

If silver can be produced here at a cost of 15 to 20c. an ounce, it is because of the exceptionally favorable character of the ore. Anything that detracts from these extremely rare conditions increases by so much the cost of extraction. In respect to silver the Cobalt district occupies about the same position as the Birmingham district, Alabama, does in respect to iron. There is no district in the world where silver is produced as cheaply as in Ontario, nor any in which iron is produced as cheaply as in Alabama, with the possible exception of the Luxembourg district, Germany.

EXTENSION OF THE AREA

The extension of the workable area east from Cobalt and between Cross lake and Temiskaming lake is now in progress. The Trinity company is installing machinery on its claim directly on the east side of Cross lake, southeast of the King Edward, Silver Cliff and other mines on the west side of Cross lake and about half way from this lake to Lake Temiskaming, the Big Fissure company has sunk its main shaft 105 ft. and is preparing to drift along the vein 200 ft. to a connection with another well-defined vein. This company has also unwatered an old shaft that was sunk 40 ft. on a separate vein and will carry this down 110 ft. deeper. The property of the Wabi company is between the Big Fissure and Lake Temiskaming and it is reported that operations are to be resumed there.

These operations between Cross lake and Temiskaming lake will furnish new data in respect to a region not yet explored. The finding of sheet silver between a thin calcite vein showing cobalt and the wall rock of gabbro on the Big Fissure property has encouraged the owners to add new equipment, to deepen one of the shafts to the 150-ft. level and to drift along two well marked veins. This work is now in progress and should be completed within four months.

There is a confidence in Cobalt properties which persists whatever may be the fluctuations of the stock market. Silver will be produced more cheaply in Cobalt than in any other district in the world for many years to come.

Pachuca and Real del Monte Silver District

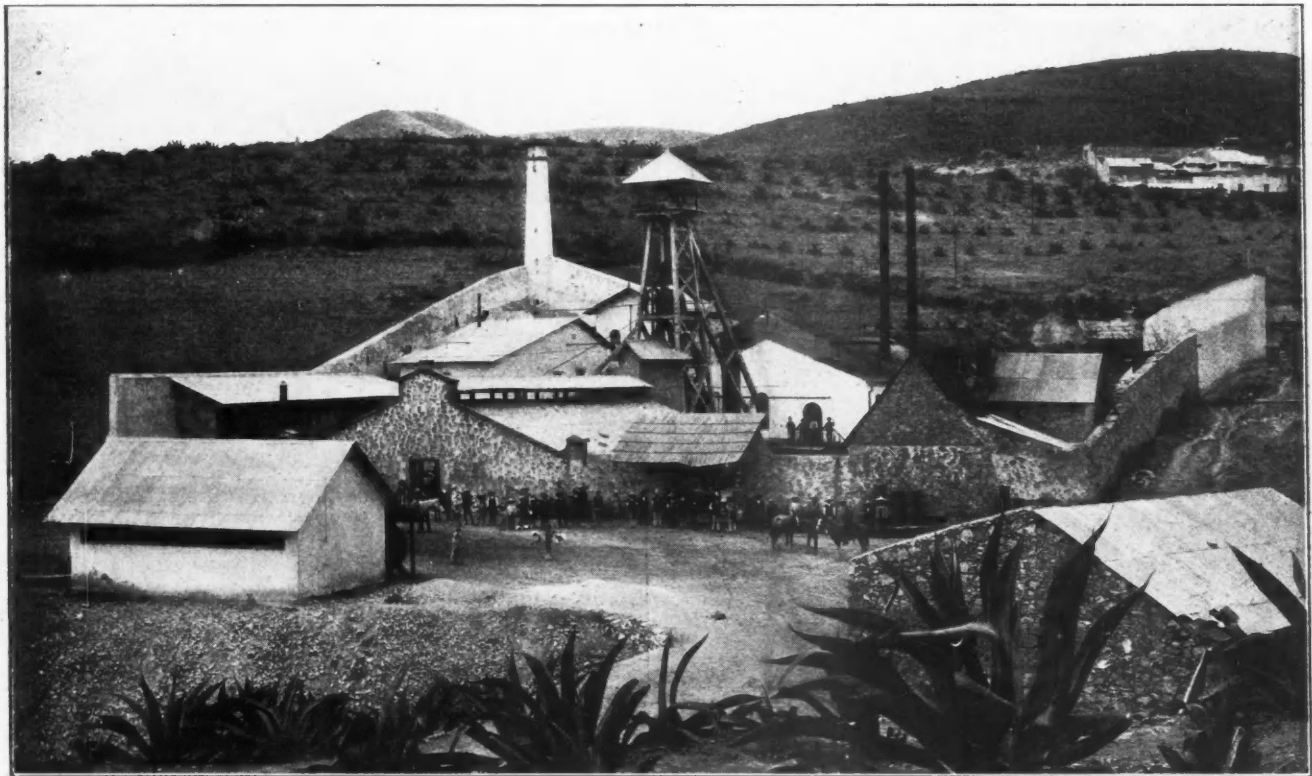
The Silver Ore Contains Little Gold; Mining and Milling Methods Are Being Rapidly Modernized; Much Construction Is Under Way

BY CLAUDE T. RICE

The silver-producing area in Hidalgo, of which Pachuca and Real del Monte are the most important camps, is possibly the oldest silver-mining area in Mexico, for the Aztecs worked these silver deposits long before the coming of the Spaniards. It was not long after the Conquest (some say only two years) before the Spaniards themselves began to work the Pachuca veins. While Pachuca is much older than Guanajuato, it has not the same romance attached to it, for at Pachuca the bonanzas have been smaller

in fact, in the two excellent monographs on this area published by the Instituto Geologico Mexicano (to which I am greatly indebted for much of the geological information concerning the district) each of these camps is treated separately. But in this article, Pachuca and Real del Monte, only a few miles apart, with one master vein, the Vizcaina, connecting the two, having a similar country rock of porphyritic andesite, and the same ore minerals in a similar vein matrix, will be considered as

the hills. The summit of the hill above the town of Real del Monte is covered with a beautiful grove of oaks, whose un-Mexican character, together with the gable-roof adobes that form the town, and the white-fenced graveyard with shading firs almost force one to imagine himself in some other land. Indeed, Pachuca is often called the "Cousin Jack" camp of Mexico, and appropriately so, for the gable-roofed houses throughout the district, the predominance of headframes at mines abandoned years ago, the numerous



THE CAMELIA MINE; REAL DEL MONTE Y PACHUCA COMPANY; PACHUCA

than those in the Veta Madre and the ore has generally required milling on the spot. Consequently, Pachuca can only name one man, Pedro Terreros, later the Conde de Regla, whom the richness of its mines has ennobled. Instead of noblemen it proudly boasts of that greatest of Mexican scientists, Bartolemé de Medina; the visitor still sees the now idle *hacienda*, the Purisima Grande, where 350 years ago Medina discovered and developed the patio process.

Frequently this silver-producing area is referred to as the Pachuca district, but more often Pachuca and Real del Monte are considered as two separate districts;

forming the Pachuca and Real del Monte district.

Pachuca, the capital of the State of Hidalgo and also the main city, is situated at an altitude of about 8000 ft., in a narrow valley near the base of the western slope of the ridge that bounds the Mexican plateau on the east. The town, although said to have a population of 35,000, has few pretty buildings, handsome statues or magnificent churches.

The hillsides on the Pachuca slope of the range are covered with a sparse vegetation, but on the eastern or Real del Monte side, owing to the abundant precipitation, a luxuriant vegetation covers

Cornish pumps, the Spanish-speaking, English-featured Mexicans, or the "yorks" that occasionally some Mexican shiftboss sports as proudly as any Northumberlandman newly arrived in some mining camp far from his home—all these constantly remind one that Englishmen worked these mines almost a century ago.

The early history of Pachuca mining is interesting for romance, hinted scandal, and rapine are mixed with it sufficiently to make it vitally so; but the present is of more importance than the past. Still, in passing I must mention the great fight that the early Mexican miners made against the water, for in 1781 at the Real

del Monte mines alone there were 28 *mala-cates* running that required 400 men and 1200 horses at an annual cost of \$250,000 to operate them.

About 2½ years ago 98 per cent. of the stock of La Compañía Minera de Real del Monte y Pachuca was purchased by the United States Smelting, Refining and Mining Company; since then it has been building or remodeling cyanide mills, installing electric pumps in the mines and erecting an aerial tramway. The Loreto and Guerrero mills are being used to determine the best system for treating the ore; when this is determined, the company will enlarge the present mills and

tract consists of a mass of Tertiary eruptives overlying the Upper Cretaceous sediments which outcrop near Regla to the east of the mines. Immediately overlying the sediments is a small flow of basalt, but the main rock of this eruptive series is the porphyritic andesite in which all the veins occur. This andesite is more than 2000 ft. thick. Farther to the east around Real del Monte the summits of the higher hills are capped by rhyolite, and still farther to the east by basaltic flows. This mass has been eroded into deep gulches and rolling-topped ridges so that the andesitic base of the mass forms most of the hills. A few rhyolite

Analcos vein, in the Xacal mine, two branches. The north-south system is characterized by simple fracturing with only occasional branches.

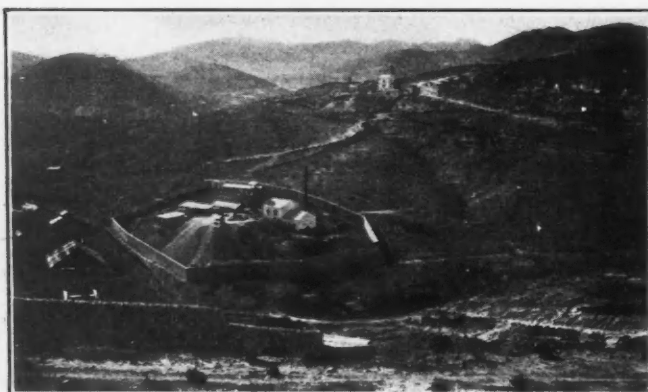
All in the district do not agree as to the relative age of these two systems of fracturings, but, since several of the north-south veins are displaced by the east-west veins, and because of the different character of the fracturing in the two systems, it seems that the fracturing must be of different ages and that the north-south fracturing must be the older. Still some think that all the fracturing occurred practically at the same time and, as indicating this, they point to the fact



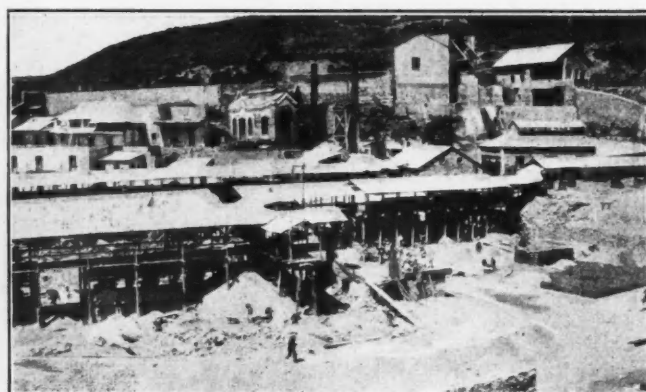
SANTA GERTRUDIS MINE, PACHUCA



BARRON MINE, BLANCA IN DISTANCE, PACHUCA



DINAMITA AND SANTA ANNA, PACHUCA



SAN RAFAEL MINE, PACHUCA

erect others so as to treat the large tonnage necessary to decrease the proportionate cost of pumping, which is high at present.

One of the most important things for the district has been the bringing in of electric power. The first plant, the one using the water power at the Hacienda de Regla, was built in 1896, but its capacity has since been increased so that it can now furnish 3000 h.p. The other plant, at Irigadora, built in 1898, now has a capacity of 6000 h.p. This power, which is transmitted at 40,000 volts, is generated by the fall obtained from the sewage of Mexico City.

GEOLOGY

The Pachuca and Real del Monte dis-

dikes occur in the district, more in the eastern than the western part.

The region has been fractured along an east-west and also along a north-south system of fissures, the main system being the former. The Vizcaina vein seems to be the master vein of the district, and from it extend many important branch veins, such as the Maravillas, the Analcos and others. Near Pachuca there is little indication of the north-south fracturing, but near Real del Monte the north-south veins appear to be the more important. Only these are being worked at present. The east-west system is characterized by compound fracturing, for in the San Rafael, the Vizcaina vein has six different workable branches; the Maravillas vein, in the mine of that name, three; and the

that the Santa Inez vein ends in stringers near the Vizcaina instead of continuing a strong vein to the Vizcaina.

Whether or not the fracturing occurred at approximately the same time, the mineralization in the two systems occurred at the same time, for the ore follows for some distance, sometimes in both directions, along many of the east-west fractures where they displace the north-south veins. Besides, the similar mineralogical character of the filling in both systems and the constancy of the silver and gold ratio (five grams gold per kg. of silver per metric ton) throughout the district seems to prove that the veins were filled by the same character of solutions and therefore probably at approximately the same time.

The dip of the east-west system varies in the different veins from almost vertical to 60 deg. toward the south. The veins of the north-south system dip to the east at a high angle, averaging about 80 deg. and varying between 85 and 65 deg., rarely being as flat as the latter figure.

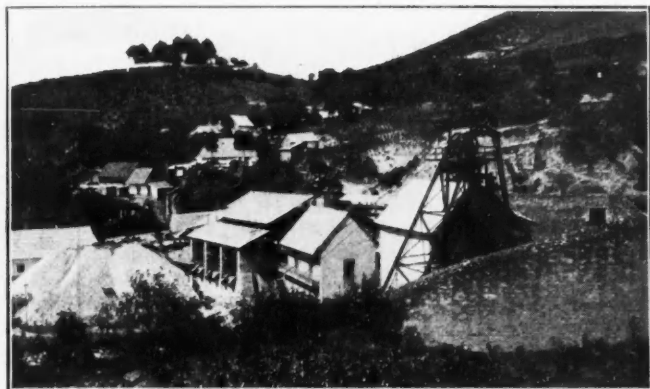
The veins in the district are not characterized by definite walls, but generally one wall is fairly well defined. Frequently tongues of porphyry project into the ore, but rarely do large "horses" occur in the Real del Monte veins, although, of course, "horses" are characteristic of the compound, branching fracturing of the Pachuca area. In places on both systems there has been a movement in the vein subsequent to its filling, and near this

there is much rhodonite the ore is rich in silver. This rhodonite is more characteristic of the Real del Monte than of the Pachuca veins, but some of the latter, for instance the Maravillas and the Santa Gertrudis, contain much manganese. Other vein minerals are pyrite, galena, and occasionally chalcopyrite, blende and calcite. Both the pyrite and galena are argentiferous, but the pyrite carries only a little gold.

In many of the veins the ore found at a depth less than 300 ft. is low grade. Local tradition has helped to establish an impression that this is true throughout the district, but the bonanza orebodies found at surface at the Xacal, the Cristóbal, and the Rosario mines are notable exceptions

These veins contain shoots of good ore, and several, such as the San Jose y San Pablo, the San Felipe, and the Moran vein, have been mined in the past; in fact, the Moran vein has produced along a length of 800 meters.

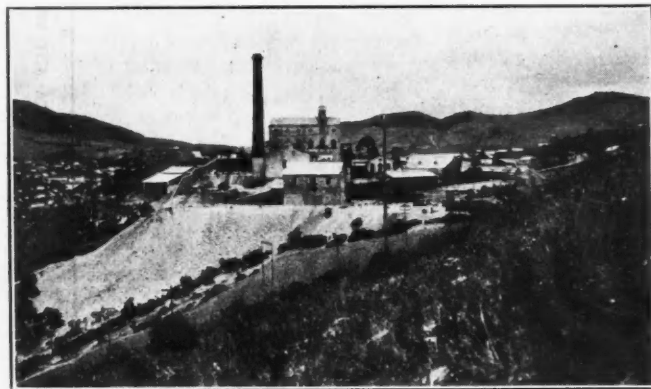
From the upper part of the Vizcaina vein a large amount of silver has been obtained. The east end of this vein has been worked to a depth of 1300 ft., but at present no work, except sampling, is being done on that end of the Vizcaina. Near Pachuca, however, the San Rafael and Camelia are producing considerable ore from this vein. The Vizcaina vein does not end at Real del Monte, but extends farther east and passes under the basaltic capping in that part of the country.



DOLORES MINE, REAL DEL MONTE



SORTING ORE, CABRERA MINE REAL DEL MONTE



DIFICULTAD MINE, REAL DEL MONTE



SAN IGNACIO SHAFT, REAL DEL MONTE

plane of movement much of the silver has been leached out by the water following down along the fracture. Frequently along the footwall a thin clay gouge is observed.

The gangue in both systems is highly silicious, and in many of the veins much amethystine quartz is found. In the oxidized portion of the vein the silver occurs native, and as chloride, iodide and bromide; in the sulphide zone argentite is the main silver mineral, although some stephanite and polybasite are found and occasionally at the Barron mine in the deepest level a little ruby silver is to be found. In many mines in both camps much rhodonite is found; generally where

to this rule. The large orebodies generally are found at or near the juncture of a branch with the main vein or where a cross-fracture has cut the vein; it is peculiar that throughout the district the wider the orebody, the richer is the ore.

THE REAL DEL MONTE VEINS

The main veins in the Real del Monte area belong to the north-south vein system, but connecting this area of mineralization with the one about Pachuca is the Vizcaina, which has an east-west strike. The other east-west veins in the eastern part of the ore zone are small, and show that the buckling that produced this series was not nearly so strong as farther west.

It is notable that no trace of the north-south fissuring has been found to the south of the Vizcaina vein. This fact, were it not that the Santa Inez vein seems to "peter out" as it approaches the Vizcaina, would unquestionably indicate a great displacement of the southern area to the east; but until more is known about the Santa Brigida vein in the vicinity of the Vizcaina vein, this question of displacement must remain undecided. The Vizcaina vein is approximately vertical with a tendency to dip at a high angle to the south.

The Santa Inez vein, although one of the last to be mined in the Real del Monte district, is at present the most im-

portant, for from it comes most of the ore being mined for the Guerrero mill. The vein varies in width from 10 to 40 ft., and the ore, as is characteristic of the veins at Real del Monte, carries much rhodochrosite and amethystine quartz. The proved workable area is about a kilometer long, the largest production coming from the part between the Difcultad shaft and the Terreros shaft, which is sunk near where the Santa Inez joins the Vizcaina vein. The vein dips about 85 deg. to the east as does its approximately parallel sister vein, the Santa Brigida, which is farther to the east.

At the north end, which is worked through the Dolores shaft, the Santa Brigida vein is displaced by several small east-west faults that generally throw the north end to the west. The ore often makes out along these cross-fractures, but it is peculiar that none of these small faults affect the Santa Inez vein. Another difference is that the Santa Brigida vein splits in several places, while the Santa Inez does not show any such tendency. Near the Dolores shaft the Santa Brigida vein is from 10 to 15 ft. wide, but to the northward the vein widens, and at the Acosta shaft it has its greatest width, 30 ft., in some of the upper bonanzas of that mine. Characteristically the Santa Brigida vein is quite variable; it suddenly contracts and widens, and sometimes it splits, sending off spurs into the country.

North of the Acosta shaft the Santa Brigida vein is cut by the Gran Compañía vein; soon afterward the Santa Brigida splits into two branches, the eastern one of which is called the Escobar vein. North of the Escobar shaft the vein is faulted. Many think that the Cabrera vein is the extension of this vein. If that is true, then also along this fault the north block had been thrown considerably to the west. The San Juan and the San Louis veins also belong to the north-south series of veins, but are smaller and less important.

THE PACHUCA VEINS

In the Pachuca area there are three main vein systems, the Vizcaina, the Analcos, and the Santa Gertrudis. The Vizcaina vein continues westward from Real del Monte, but only occasional outcrops are seen. It extends beyond Pachuca, and it is said that the Vizcaina fracture can be traced several kilometers farther west. Although the main vein of the east-west series and the master vein of the camp, the Vizcaina vein was not worked for many years after the Analcos because along the western portion rich ore does not outcrop. But at present most of the ore mined in the district comes from it.

The Vizcaina vein is a compound break composed generally of three parallel ore-bearing fissures, each from 1 to 5 or 6 m. wide. Along most of its length there are only three main branches, but in the central part of the San Rafael mine there

are six workable branches to the Vizcaina vein; these again reunite into the usual three branches farther west. The Camelia, the San Rafael the largest single mine in the district, the Bordo, the Santa Ana and the Dinamita mines are the only ones at present working along the Vizcaina lode; only the first two of these are mining a large tonnage. The Camelia mine is 385 m. deep, and the San Rafael 500 m. deep (475 m. below the mine patio).

The drainage of the Vizcaina vein is greatly aided by the Girault adit, driven jointly by the San Rafael and the Real del Monte y Pachuca companies; this cuts the Vizcaina vein in the San Rafael mine on the 225-m. level, and in the Camelia on the 170-m. level.

Many important branch veins extend from the Vizcaina; indeed some think that future development will show that all the veins in the western part of the district are branches of the Vizcaina. The Maravillas vein, whose point of departure from the Vizcaina is debated in the district, and the Analcos system of veins, which branches from the Vizcaina near the Reunion claim, have already been shown to be branches from the Vizcaina.

The Analcos vein was the one first worked in the western area, for along it are the Xacal, the San Cristóbal, the Rosario and the San Juan mines. In most of these the rich ore outcropped at surface. At present these mines, which belong to the Real del Monte y Pachuca company, are not worked.

The other important vein system is the Santa Gertrudis, to the east of Pachuca. On this vein the Santa Gertrudis, the Amistad, the Barron (one of the best mines belonging to the Real del Monte y Pachuca company), and the Blanca mines are working. Mining on this vein, like a great deal of the mining on the west end of the Vizcaina, is quite recent, for it began only a few years prior to the organization of the Santa Gertrudis y Anexas company in 1875. Although it is said that a line of outcrops can be traced from the Guadalupe and Fresnillo veins to the Santa Gertrudis, no mining is being done on these intervening outcrops, and the Santa Gertrudis, which is about 475 m. deep, is not only the deepest mine on this vein, but also the one farthest west. The Barron, the next deepest, is 450 m. deep, but the main shaft is being sunk another 50 m. so as to open up new ground.

At present in the Barron mine, the vein above the 425-m. level has been worked fairly thoroughly so that most of the ore comes from the stopes between the 425-m. and 450-m. levels. The Santa Gertrudis vein is widest on the west. In the Santa Gertrudis company's ground, near the west end line of the Barron mine, it is fully 35 ft. wide; but farther east the vein seems to decrease in width, narrowing to about 15 ft. on the east end of the Barron mine. The vein

varies greatly in width and in richness, some of the ore shipped from the Barron mine averaging 20 kg. silver and 90 to 100 grams gold per ton. The Santa Gertrudis vein has a tendency to send off branch veins, for in the Barron a branch puts off to the north and also one to the south. The vein dips about 60 deg. to the south.

There are several other important veins near Pachuca, such as the Maravillas, from which about 100 tons of ore per day are being mined, and the Corteza, which was worked considerably in the past and from which the Real del Monte y Pachuca company is shipping some sorted dump ore. To the north of Pachuca a few miles is the Chico district, in which there is an east-west system of veins quite similar to the Pachuca veins, but at present, far less developed.

METHODS OF MINING

Several methods of mining are used in the Pachuca and Real del Monte district. At Real del Monte, where the veins are nearly vertical and the wall rock strong, underhand stoping is used, and the ore blasted into mill-holes. These are sunk from the level above, for in this, as in most camps of Mexico, driving a raise costs more than sinking a winze. Underhand stoping is well adapted to Mexican labor, but a possible disadvantage is that only the ore in the mill-holes and bins at surface is held in reserve. This is also true of the method of mining generally used on the Pachuca side where overhand stoping with waste filling is used; in this method as used at Pachuca, horizontal cuts 2½ m. high are taken along the vein, and the ore is broken onto floors to keep it from mixing with the waste. The waste filling is carried along close behind the drillers for, owing to the flatness of the vein, in some places, the ground is quite heavy; cribbed chutes are carried up through the waste filling as stoping progresses. In some of the heavy stopes, notably in some parts of the San Rafael and the Santa Gertrudis mines, square sets are used, the sets being subsequently filled.

At the Camelia mine overhand stoping with ore-filled stopes will be used, the excess ore being drawn through "Chinamen," until the stope progresses enough to allow the ore to be drawn through the cribbed chutes that are carried up in the ore filling. When the ore in the stopes has been broken from level to level, the ore will be drawn and waste filling will follow it down.

Much dry walling is used in lining the drifts along the vein, the arch being made of cut stone, but this cracks badly under pressure. At the Barron mine rock-lined

"Chinaman" is the local name in Australasia for a system of timbering drifts in which the lagging runs crosswise instead of lengthwise with the drift. By moving a few of the lagging closer together ore can be drawn into a car on the track below.

drifts that apparently would have lasted forever, have become so badly cracked in a year's time that timbers will soon be needed to hold open the drift. This stone lining, including the cost of the cut rock forming the arch, costs in place 50 pesos per meter. Timbering a drift including cost of timbers and framing, costs only 16 pesos per meter, and lasts from nine months to a year. In the future, at the Real del Monte y Pachuca properties, as the timbers are cheaper and can be "eased" or replaced readily when necessary, the main levels, instead of being lined with masonry, will be timbered.

Owing to the great weight in some parts of the Barron mine a lateral drift is driven in the foot-wall in order to work those portions of the mine, but this, I think, is the only mine in the district where a lateral drift is used.

Most of the drilling in the camp is done double-hand, but a few air drills are used in some of the mines, mainly

and the cost of explosives is relatively high and that of labor small, the easier drilling and breaking of the softer ore about balances the increased cost of shoveling.

PUMPING

At Pachuca pumping on the Vizcaina vein and to a less extent on the Analcos vein system is aided by the Girault adit. At Real del Monte, all the mines are connected with the Aviadero adit which cuts the Santa Inez vein at a depth of 300 m. At most of the other mines, for instance, the Barron, short adits have been driven to drain the upper workings. Consequently, at no mine does the water have to be pumped to the collar of the shaft. At present the water pumped from the Real del Monte mines amounts to 4500 gal. per min., 1100 gal. of which comes from the Dificultad shaft. But in Pachuca the amount of water is considerably less; from the San Rafael mine, 400 gal.; from

is employed with one or two exceptions, to run all machinery at the mines. The Compañía de Potencia Eléctrica de Estado Hidalgo (the Landero company) can furnish 3000 electrical horsepower, generated at Regla, 20 miles from Pachuca, while it has in reserve in case of accident a 1500-h.p. steam-turbine generator-set in Pachuca. The Compañía Irigadora é Eléctrica has a capacity of 6000 h.p. distributed between its three plants. At all the plants impulse wheels, directly connected to the alternators, are used. According to the amount of power covered by the contract, the cost varies from 96 to 150 pesos per horsepower per year. The electric current is carried underground at 1040 volts and is transformed to 440 volts for the motors other than those operating the pumps.

MINES IN OPERATION

In Real del Monte the Santa Inez vein is worked the most extensively. The Dificultad shaft is used for sinking, pumping and lowering timbers, while the ore is hoisted through the San Ignacio shaft. The Santa Inez vein is worked to a depth of 440 m. The Santa Brigida, San Juan and San Louis veins, all having a north-south strike, are worked through the Dolores shaft. This at present is 500 m. deep, but is being deepened; the lowest level is the 475-m. level. The Dolores shaft has a steel headframe 60 ft. high, and at the San Ignacio shaft a similar one will soon be erected. The Cabrera and the Escobar veins are also being worked. The Cabrera shaft is 255 m. deep. The ore coming from this mine is oxidized, and, therefore, heavily stained with manganese oxide. The vein is about 4 m. wide in the widest stopes, but the ore is the richest mined in Real del Monte.

The ore from the Escobar, Cabrera, and Santa Inez mines goes to the Guerrero mill. At the Dolores shaft only the richer ore is hoisted at present for only the shipping ore can be sent away. The milling ore that is sorted out is held at the mine. The ore from the Escobar and the Cabrera mines is hauled by mules to the Guerrero mill. The ore from the Santa Inez vein is conveyed from the San Ignacio shaft to the Guerrero mill by a Pohlíg aerial tramway, which is equipped with a bucket counter and weigher, and also an automatic governor. It is probable that this tramway will be extended so as to handle the ore from the Dolores shaft. At present about 300 tons of ore from the Real del Monte mines is being milled, but considerably more ore is broken, and is accumulating in the stopes and at surface.

At Pachuca, the San Rafael, the Maravillas, the Camelia and the Barron, belonging to the Real del Monte y Pachuca company, the Santa Gertrudis, the Blanca and the Amistad mines, are hoisting much ore, while the Santa Ana, the Bordo and the Dinamita mines are working on a small scale. The San Rafael mine, which is a little over 500 m. deep, is mining about



CABRERA MINE, REAL DEL MONTE Y PACHUCA COMPANY, REAL DEL MONTE

for driving or for sinking. In this district, owing to their association with Cornishmen, the Mexican miners use long-handled hammers, and do not "choke the hammer to death," as at Guanajuato, where a hammer handle 22 in. long is often seen and even appears to be characteristic.

Driving a 2x2-m. drift costs from 30 to 40 pesos per meter, while a crosscut of the same size costs from 40 to 50 pesos. Mining, inclusive of development, costs from 6 to 10 pesos per metric ton, for in many of the stopes 60-per cent. dynamite must be used, and owing to the hardness of the rock a pair of miners can only drill 9 to 12 ft. per shift.

Practically all the mining in the district is done on contract. At some mines the stopers are paid by the cubic meter; in others by the running meter, the miner breaking the vein from wall to wall, no matter how much it varies in width. As the ore is softer in the wider portions

the Camelia, 250; and from the Barron, 300 gal. are pumped. The Santa Gertrudis, the Bordo and the San Juan mines are also pumping, but what amounts I do not know.

Practically all the pumping in the district is done by electric pumps. Some of these are plunger pumps, but more are centrifugal pumps. A few electric sinkers are used, but these have not proved very satisfactory. While in the past many Cornish pumps were used, now, owing to the high cost of power, nearly all of these have been shut down. Many of them have been dismantled, but at some of the shafts, for example, the Dificultad, the Dolores and the San Juan, the Cornish pumps and the boilers are held in readiness for use in case of breakdown to the electric-power system. The Cornish pump at the Dificultad shaft, which is of the Rittenger type, is a monster, having a capacity of 2000 gal. per min. and an 8-ft. stroke.

Owing to its low cost, electrical power

500 tons of ore per day, but about 30 per cent. is sorted out either as waste, or as ore good enough to mill when the company's own mill is running. This sorted milling ore is too low-grade to pay to send to custom mills, which purchase the ore, charging about 20 pesos per ton for treatment, inclusive of the cost of quicksilver and other chemicals lost, and paying nothing for the gold in the ore. The Real del Monte y Pachuca company is mining about 600 tons of ore per day, about 60 tons of which is shipped.

At Pachuca the ore is not so easily handled as at Real del Monte for at present it has to be hauled in mule cars to the different mills. In time this will be remedied by building cyanide plants near the larger mines. Then only the ore from the smaller mines will be hauled to distant mills.

SORTING THE ORE

At present, owing to the tonnage milled locally (extremely small compared with the possibilities of the camp), the special rates that the smelters offer for silicious ores, and the comparatively high treatment charges at the local mills, not only concentrates but also all ore assaying 2 kg. silver or better per ton are shipped to the smelters. This rich ore is obtained by sorting the ore that does not pass a 1-in. grizzly. At some mines the large pieces from the oversize of the 2-in. grizzly are crushed in a Blake breaker, but at others the sorters break the larger pieces with hammers. The cost of sorting ore by contract is at the Dolores shaft 2.25 pesos per ton of ore shipped; at the San Rafael, 1.40 pesos, and at the Cabrera, 1.40 pesos, the difference being due to certain circumstances, such as the manner of breaking the coarse ore and the amount of shipping ore in the run-of-mine ore. The work of the sorters is kept efficient by sampling the milling ore and the waste as well as the shipping ore.

At the San Ignacio shaft the ore is sorted on a Robins belt conveyer. The ore below 1-in. size goes to the mill direct, but the oversize from the 2-in. grizzly is crushed in jaw breakers before joining the oversize from the 1-in. grizzly which feeds direct to the inclined Robins belt. The ore is washed with water as it is elevated up the incline; women, paid 50 centavos per day, sort out both the shipping ore and the waste. Ore assaying over 200 grams silver per ton is sent to the mill but that which assays over 2 kg. is shipped. There are 15 of these women, one expert women picker, paid 1 peso, who picks over the ore and waste sorted out by the others, and one boss, a man, who is paid 1.50 pesos. The cost when 150 tons per day are sorted is 10 centavos per metric ton. Throughout the district men do the sorting when the ore is broken by hand, but the Pachuca y Real del Monte company has found that when a picking belt is used

women do the better work. This is also the experience at Guanajuato.

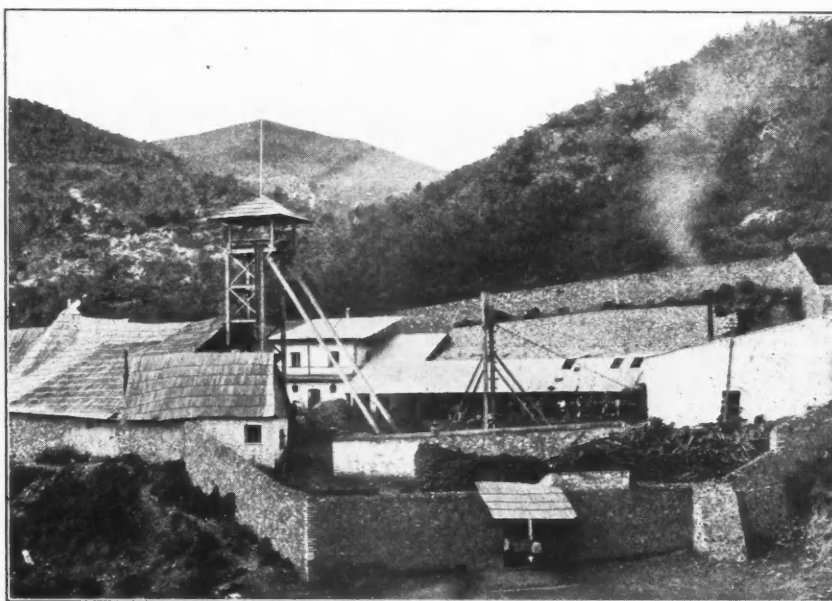
The wages paid in the district are as follows: *Peones* on surface, 75 centavos; *peones* underground, 1 peso per 10-hr. shift; miners on day's pay, 1.25 pesos; timbermen, 1.25 to 2.50 pesos; carmen, 1 peso; cagers, 1.40 pesos; hoisting engineers, working 8-hr. shifts, 14 to 18 pesos per week; pumpmen, 3 pesos; shift-boss, 3 pesos; blacksmiths, per 10-hr. shift, 2.50 pesos; blacksmith helpers, 1.25 to 1.50 pesos.

At the Real del Monte mines, 1000 men are on the pay roll; at the San Rafael, 2000 (but considerable construction is going on and about 175 men are working in the *patio* sorting the ore), at the Barron, 350 men; at the Camelia, 350 men. The Santa Gertrudis and the Blanca are the only other mines that are employing many men; probably they employ 550 men between them. The small mines em-

the miners in the old days of the *patio* process and steam power did not mine ore assaying less than 500 to 600 grams silver, there is much ore in the old workings which now will pay to mine.

CONCLUSION

The future of Pachuca looks very encouraging, for with a good supply of electric power, a fairly efficient labor, and many good mines it only awaits the erection of more cyanide plants to take the place among silver-producing districts which it occupied years ago. As it is, the rapid modernizing of the district, which has been so conspicuous during the last 18 months, has been due to the example set by the Real del Monte y Pachuca company, which during this time has been gradually modernizing the methods of mining, milling and even book-keeping. Being a conservative company, this has taken time. At Pachuca, the



THE ESCOBAR MINE, REAL DEL MONTE Y PACHUCA COMPANY, REAL DEL MONTE

ploy about 100 men more, making the total number employed underground in the district about 4000 men. Probably never more than two-thirds of this number are working at one time.

Throughout the district there are several good-sized dumps that will average 400 to 500 grams silver and 2.5 grams gold per ton, but these, with the exception of the dump at the Corteza mine which is being sorted for shipment, are not being worked because the mines furnish a tonnage of heads, assaying from 700 to 1000 grams silver, far in excess of the milling capacity of the district. At present the ore milled assays on an average about 1 kg. silver per ton, but ore considerably lower in grade can be treated as is shown by the fact that at the San Ignacio shaft the content at which the ore already mined and at surface will no longer pay for treatment is 200 grams silver per ton. Consequently, as

period of experimenting is passing, and soon the metallurgy of the ores will be proved by the mills just completed, and those now being built. In closing, I must draw attention to the fact that it was here that A. Grothe first introduced the Brown tank outside of Australia. To him great credit is due for this boldness.

I wish to thank all the men in charge of mines and mills at Pachuca, all of whom were very kind to me; especially V. B. Sherrod, consulting metallurgist to the Real del Monte y Pachuca company, R. H. Lyman, assistant to the manager, E. B. Merrill, of the same company and Edmundo Girault, manager of the San Rafael y Anexas company.

In conclusion I wish to state that, provided silver will return to 60c. per oz., I expect to see Pachuca the largest silver producer in Mexico within the next seven years.

American Smelting and Refining Company

The brief annual report issued by this company for the year ended April 30, 1908, is devoted to the financial affairs of the company; it contains no statements of the production of metals by the various plants of the company. The balance sheet, compared with that of 1907, is as follows:

| ASSETS: | 1907. | 1908. |
|--------------------------------|----------------------|----------------------|
| Property..... | \$ 86,845,671 | \$ 86,845,672 |
| Investments..... | 3,810,595 | 3,950,088 |
| Metals on hand..... | 18,251,587 | 17,519,664 |
| Materials on hand..... | 1,317,544 | 1,380,742 |
| Net current assets..... | ..... | 500,526 |
| Cash and demand loans..... | 6,706,984 | 5,629,034 |
| Total assets..... | \$116,932,381 | \$115,825,725 |
| LIABILITIES: | | |
| Capital stock..... | \$100,000,000 | \$100,000,000 |
| Bonds..... | 457,000 | 349,000 |
| Net current liabilities..... | 459,051 | ..... |
| Unearned treatm't charges..... | 2,639,301 | 2,068,506 |
| Surplus..... | 13,397,028 | 13,408,219 |
| Total liabilities..... | \$116,932,381 | \$115,825,725 |

Under the requirements of the mortgage, the outstanding bonds issued by the Omaha & Grant Smelting Company, and maturing in 1911, have been reduced by the sum of \$108,000, leaving now outstanding \$349,000.

The income account for the two years may be compared as follows, the earnings given being the net earnings over operating expenses:

| | 1907. | 1908. | Changes. |
|--|---------------------|---------------------|----------------------|
| Earnings..... | \$13,250,058 | \$ 9,403,282 | D. \$3,846,776 |
| General expenses \$ 763,854 | \$ 836,866 | I. \$ 73,012 | |
| Ordinary repairs 976,535 | 983,130 | D. 43,405 | |
| Employees profit sharing fund... 540,420 | ..... | D. 540,420 | |
| New construction \$1,054,996 | 622,096 | D. 432,900 | |
| Total..... | \$ 3,335,805 | \$ 2,392,092 | D. \$ 943,713 |
| Net income..... | \$ 9,914,253 | \$ 7,011,190 | D. \$2,903,063 |
| Dividends..... | 7,000,000 | 7,000,000 | ..... |
| Surplus for yr. \$2,914,253 | \$ 11,190 | D. \$2,903,063 | |
| Surplus for prev. year..... | 10,482,775 | 13,397,028 | I. 2,914,253 |
| Total surplus..... | \$13,397,028 | \$13,408,218 | I. \$ 17,190 |

Taxes are included under general expenses. The president's report says: "There were deducted from the net earnings of the preceding year \$540,420 on account of employees' profit-sharing fund, and \$1,054,996 on account of new construction and improvements, or a total of \$1,595,416; whereas during the past year there has been no payment made to the employees' profit-sharing fund, and the amount deducted for improvements and new construction has amounted to \$622,096. The net amount applicable to the payment of dividends shows a reduction, as compared with the preceding year, of \$2,903,063.

"Together with most commercial enterprises in this country your company has suffered as to earnings. The simultaneous and sudden decline in the value of lead, silver and copper, together with no proportionate decline in the expenses of operating mines, notably freights, supplies and labor, made it unprofitable for many of the various mines under contract to your company to continue their usual output of ore.

This had the necessary and inevitable result of bringing about the reduction shown above. The large surplus, however, already accumulated was not impaired, and now amounts to a total of \$13,408,218.

"Preferred stock dividends Nos. 32 to 35, inclusive, and common-stock dividends Nos. 15 to 18, inclusive, amounting to \$7,000,000, have been paid regularly each quarter. The directors thought it best to reduce the dividend on the common stock for the last quarter of the fiscal year to 1 per cent., thus bringing the dividend payments within the net profits of the year, even after charging off against profit and loss the entire amount expended during the year for improvements and new construction.

"There has been completed and added to the property of the company during the past year a lead- and copper-smelting plant at Chihuahua, Mexico, which commenced operations in July, 1908. The entire cost of the construction of this plant has been charged to profit and loss, as has been the universal custom of the company in connection with new construction for the past five years.

"The slight increase in investment account is due to a reorganization of the United States Zinc Company. The earnings of the American Smelters' Securities Company were affected by the same causes as those which reduced the earnings of your company. We are pleased to state, however, that after the payment of dividends on preferred stock for the year ending May 31, 1908, there was a surplus to the credit of profit and loss account of that company of \$33,709. The various smelting plants under construction since the organization of the Securities company are now in partial operation and are fast reaching completion.

"There is a marked improvement at the present writing in the market value of copper and lead. The directors feel warranted, therefore, in expecting that the net earnings of the Securities company for the coming year will not make necessary any further encroachments upon the surplus, and it is not expected, therefore, that your company will be called upon to make any payments under its guarantee of dividends on Securities B preferred stock."

Magnalium, an Alloy of Aluminum and Magnesium

Magnalium is an alloy of aluminum and magnesium manufactured by a syndicate in Germany. It contains from 90 to 98 per cent. aluminum, and possesses properties which render it suitable for many industrial purposes. It is imported in the form of pigs or ingots for castings or forgings and its manipulation is said to require no training other than that possessed by the ordinary foundryman or blacksmith.

The chief advantages claimed for magnalium are that it can be forged, soldered, by men without special training, it can be rolled and annealed and that in all forms its strength is greater than that of pure aluminum although its weight is slightly less. The specific gravity is about 2.5, varying slightly with the composition, while that of pure aluminum is 2.64. The tensile strength of magnalium has been found by test to be as follows in pounds per square inch: Castings, 19,000 to 42,000; forgings, 30,000; annealed and hard rolled plates, 42,000 and 52,000 respectively; drawn rods, 60,000; wire, 41,000 to 53,000; and tubing 74,000. The melting point varies from 1185 to 1250 deg. F., and the specific heat is 0.2185.

The properties of the alloy vary somewhat with the composition. A small proportion of magnesium makes a good alloy for casting, but for forging, rolling or wire-drawing a larger admixture of magnesium is required. Tubing is made of material containing about 90 per cent. aluminum while rolled plates contain about 94 per cent.

The electric and thermal conductivity of the alloy is 56 per cent. of that of pure copper. The material takes a high polish and resists oxidation better than aluminum. It is unaffected by dry or damp air, water, gaseous ammonia, carbonic acid, hydrogen sulphide and most organic acids. It is very slightly affected by nitric and sulphuric acid and more rapidly by alkalis or strongly alkaline solutions. It is slightly attacked by salt water and surfaces exposed to sea water should be protected by a coat of lacquer. A multitude of articles made of magnalium are found in the European markets, varying from parts of delicate balances and optical instruments to agricultural implements, horseshoes and engine castings.

The new alloy is sold at prices only slightly higher than that of aluminum, considering its greater tensile strength and the smaller quantity required for a given purpose. Quoted prices for magnalium f.o.b. New York are as follows: Crude metal, \$47 to \$61 per 100 lb. according to quantity; wire, \$85 to \$90 per 100 lb. with extra charges for very small diameters; plates, \$80 to \$85 per 100 lb. with extra charge for plates less than one millimeter thick; rods, \$80.70 to \$85.70 per 100 lb.; tubes, \$160 to \$180 according to size; and solder \$1 per lb. A material reduction in price is made when the alloy is ordered in large quantities.

Tom Johnson (*Journ. Chem., Met. and Min. Soc. of South Africa*) states that he prefers grooved steel to octagonal steel for chisel bits since the strength is under the corners. He used 1 3/4-in. steel for a 2-in. bit, and 1 1/2-in. steel for a 1 3/4-in. bit. No trouble was experienced on account of "fitchering" as the whole width of the bit was carried for an inch back from the edge of the bit.

Short Talks on Mining Law—X

By A. H. RICKETTS*

The instability of the possessory title to a mining claim before the legal title has passed from the government has been already shown. And even in the case of a patented claim, because of the complications that may arise under the "apex rule," the patent for a lode claim may only secure title to the surface ground described therein. The patent gives no greater mining rights than those acquired by location; each confers the right to veins or lodes that may apex within the ground covered by the patent, together with the attendant right to follow the vein on its downward course (its dip) within the vertical extension of the parallel endlines of the claim and beyond the sidelines into other territory to any depth or distance. This right to follow the vein on its dip is not affected by the fact whether or not either or both claims are held by patent, or location, nor whether the vein or lode extends from one endline to another, or from one sideline to another, or from one line of any kind to another, but it is applied throughout their entire depth to all veins or lodes whose apexes lie within the surface lines of the claim. This right is subject to the same right in others similarly situated, i. e., the locator or patentee may invade other claims or have any part of his own claim invaded which lies within the extended endlines of other claims if conditions warrant. As a rule, priority does not matter.

A patent regular in form is evidence of a perfected right, and that a vein or lode lies within the area described therein, yet the fact may be that the vein or lode embraced in such ground does not apex within the limits of the patented area; then the patented portion of the vein would belong to another who possesses the apex of the vein. It is not the custom of the land department to inquire into this question as a precedent to patent, but it has been held that the charge that a vein or lode sought to be patented is located upon its dip "imposes on the land department the duty to determine the question before the issuance of the patent."

ENDLINES

It does not follow that the endlines shown in the location notice or the patent are the only endlines of the claim. Additional endlines within such lines, but not outside thereof, may be fixed by judicial decree, but a court cannot change the location by making a new endline or lines. It is said that as there may be different veins with different extra-lateral rights within the same location, "the planes which bound such rights of differ-

ent veins may be as different as the extent of their respective apexes, though all such planes must be drawn vertically downward, parallel with the endlines of the claim. The endlines of a location, or the endline planes of all veins or lodes, having their apexes therein, do not shift as endlines to accommodate the sinuosities of the vein or lode; in other words, the endlines cannot be drawn at right angles to the strike of all the veins or lodes if they do not have the same strike.

It has been held that when the apex of the vein or lode passes through one of the parallel endlines and a sideline, the extra-lateral rights are bounded by the vertical plane of such endline and a parallel plane passing through the point at which the apex crosses the sideline. In the case of a lode located under the law of 1866 (which did not require parallel endlines, although specifically giving extra-lateral rights) and patented under the law of 1872, it has been held that, where the endlines of such lode diverge from each other, extra-lateral rights on the dip are to be measured upon the dip between vertical planes drawn perpendicular to the strike of the lode through the extreme points of its length.

If the claim is laid across, instead of along, the vein or lode, the courts have held that what the locator intends shall be the endlines of this claim are really his sidelines, but that in all such cases where the apex crosses the original sidelines, the sidelines must be parallel in order to insure the extra-lateral right. If the apex of a vein or lode "bellies" beyond a sideline—i. e., passed beyond such line and recrosses the same into the claim—its owner is entitled to the vein within the walls thereof.

In this connection it may be said that it has been held that there is no limit in the Mining Act as to the portion of a vein that may be located on its width, nor for its lateral division, and that there is no provision as to how the vein over 600 ft. wide shall be located. By the terms of the law the lode claimant is entitled to locate 300 ft. on each side of the middle of the vein at the surface without any provision regarding the width of the vein. Consequently the law makes no provision as to how to determine the width of a location where only one wall of the vein or lode is discovered.

The width of the outcroppings is not necessarily the width of the vein, or lode, and the outcropping is not always determinative of the location of the vein or lode, for it may be detached therefrom. It has been held that, when the outcroppings are within the surface boundaries of two claims, the one first located necessarily carries the right to the vein or lode; but this assumes that an outcrop is necessarily its apex, which is not true. It has been held that extra-lateral rights are circumscribed by locating with con-

verging endlines. These come together in depth and limit the extra-lateral right to what the "pocket" thus formed may contain.

CORRECTION OF LINES

The surface lines may be corrected or changed at any time before patent, provided that it can be done without prejudice to the rights of others. The Mining Act does not provide for an amended location, but in most States, this omission is usually supplied by local law or local rule. Indeed it has been held that, when the lines of the location are not parallel, the locator "has the right and perhaps it is his duty, to make such change as is necessary to parallel his endlines within any reasonable time if such change interferes with the substantial property rights of no other person; that any different rule would be a disgrace to justice and an impeachment of the common sense of lawmakers." In the case in which that language was used, the claimant drew in his west sideline about 250 ft. in order to parallel his east sideline. This was done by the deputy mineral surveyor while surveying the claim in patent proceedings, and the extra-lateral right was thus obtained.

The courts are not in accord as to whether the requirements of the law as to the parallelism of the endlines are applicable universally. The mineral claimant possesses only intra-liminal rights unless the lines are paralleled in some of the ways above shown. The court cannot make a new location for the claimant or enlarge his rights; it can give him only such rights as his original location warrants.

BURDEN OF PROOF

To establish the extra-lateral right, the existence of the apex must be shown; it must also be proved that the vein or lode is in place and continuous in the sense that it can be traced from the apex into the workings or property. The burden of proof is upon the party claiming to have the apex of a vein worked by another. In aid of this he may obtain from the court an order allowing him or his agents to inspect and survey the workings of his opponent. This matter is usually regulated by local law, but, in the absence of such legislation, it is said to be inherent in a court of equity to grant the order in a pending suit. It is possible for the parties to determine their respective rights to the dip without litigation, by agreement or deed. Surface conflicts may be settled in the same way, even in patent proceedings.

WHEN PRIORITY OF TITLE GOVERNS

When the question of priority arises as to surface rights of unpatented ground, seniority of title governs. The question is concluded by the patent. In other cases the date of the patent is not conclusive of the time when the right was

*Member of the San Francisco Bar, San Francisco, Cal.

initiated, but if the contest is between a patentee and one holding under a location made subsequent to the date of the patent, the patent prevails. If a contest arises between the holders of different patents, the date of the location may be shown by a certified copy of the patent proceedings obtained from the general land office at Washington. If both claims are unpatented, the date of location must be proved as in other cases.

The Mining Act provides that priority of title governs where two or more veins intersect or cross each other or unite. The courts are not in accord as to whether or not these provisions are in conflict with or supplemental to other parts of the statute conferring rights upon a locator, i. e., whether such provisions do or do not limit the exclusive rights given the senior location.

A Selective Electric Fuse Spitting Device

BY ROBERT N. BELL*

Spitting holes in shafts, especially in wet ground, is hazardous work, and the danger has been greatly increased by the introduction of electric hoisting. With electric-power systems the loss of power is sudden and without warning, while in the case of air or steam there is a gradual dying away of the power. Hence, there is danger of the failure of the electric power between the blasting signal warning the engineer to be ready to hoist, and the final signal for hoisting the miners away from the blast.

Since even the best of electric-power systems are liable to fail, especially when the transmission line is long, the solving of the problem of blasting without the attendant danger of being caught when the holes are fired, has been given much study. Of course, simultaneous blasting by electric current is possible, but that is not desirable in shaft work where timbers generally have to be kept close to the bottom and where the cut holes must be fired first to get the best results.

The device described in the following paragraphs was perfected at the Hecla mine in the Cœur d'Alene district, Idaho, for selective firing of holes from a distance by means of electric current. In sinking a big three-compartment shaft at that mine, the air plant being taxed to its full capacity, the hoisting had to be done from the main plant, which was operated by electric power generated at Spokane Falls, Washington, over 100 miles distant. The frequent temporary interruptions in the transmission of the power got on the nerves of the shaftmen, for they feared that the power might fail when they were spitting heavy blasts in the shaft. The

result was that the company electrician devised a plan of spitting the fuse at a safe distance so as to eliminate this danger.

ONE MISS IN A THOUSAND SHOTS

The first device used was not satisfactory, but by rebuilding it and using a higher voltage, P. C. Schools, electrician at the mine, has succeeded in bringing the machine to such a state of perfection that the misses amount to only 1 in 1000.

The perfected system consists of a firing board, where the operator tests his circuits and "spits" his holes in the order desired; a reel, on which is wound the cable carrying the wire used in spitting; and firing blocks attached to the end of the cable. The holes are charged and primed in the usual way, and the spitting wire shown in the accompanying illustration is inserted in a slit cut in the fuse near its end. The fuse is wrapped tightly with electrician's tape, and thoroughly coated with axle grease, so that the juncture is practically water-proof and the spitting can be done successfully under water.

The spitting ends are all prepared before going into the shaft and the fuses are all cut the same length, as the operator gives the time interval between holes when he inserts the plug at the firing board. Each fuse has two leads of a spitting wire projecting from its end. The cable containing the wires with the attached firing blocks, which is kept on a reel in the station on the next level above the shaft bottom, is now lowered to the bottom, and the two No. 16 annunciator wires projecting from the fuse of the first hole to be fired are securely wrapped around the two heavy copper leads of block No. 1. This gives hole No. 1 direct connection with the firing board on the level above. Holes Nos. 2, 3, 4, etc., are then attached to the numbered blocks in the order in which they are desired to explode.

The system shown in the accompanying illustration is designed for a 24-hole round, which, of course, can be used for fewer holes, if desired; the number of holes can easily be increased, but that rarely would be necessary.

TESTS INSURE IGNITION OF THE FUSE

When all the holes are ready to be fired, the men are hoisted to the firing station, and the circuits are tested out. To test the circuits, the main-line switch is closed and care taken that the single-pole firing switch is open, for it is impossible to spit a fuse unless the firing switch is closed. This firing switch is kept in a box under lock and key, and only one man on each shift has a key to open it. The flexible cable and plug is then inserted into each of the holes in the firing board numbered to correspond to the holes below to be fired. If the circuits are closed, and ready to be fired,

the lamps at the top of the board will light. If the lamps should not light, then there is something the matter with the circuit that must be remedied. If all the circuits test closed, then the shots are ready to be fired.

To fire the shots, the main line switch is closed, the firing-switch box is unlocked, and plug inserted into No. 1, the lamp lights, the firing switch is closed. This short circuits the lighted lamps causing them to go out, and at the same time applies 440 volts directly across the No. 26 tinned iron wire in the fuse at the bottom of the shaft. This wire melts with a blinding flash, spits the fuse, and burns itself free. The firing switch is then opened immediately so that if an arc is maintained at the fuse it will be smothered by the cutting in of the lamp resistance. With the plug still in No. 1, and the firing switch open, failure of the lamps to light indicates that the spitting wire at the bottom did its work and the fuse is now burned, but if the lamps again light up brightly, it indicates that the fuse did not spit and that the firing switch must again be closed. It is seldom, if ever, that the firing switch has to be re-closed.

LITTLE ADDITIONAL TIME REQUIRED

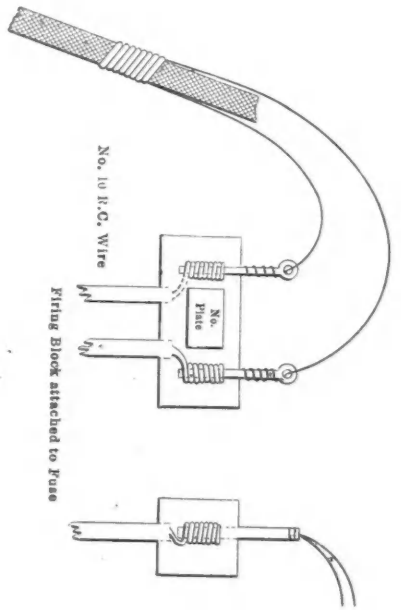
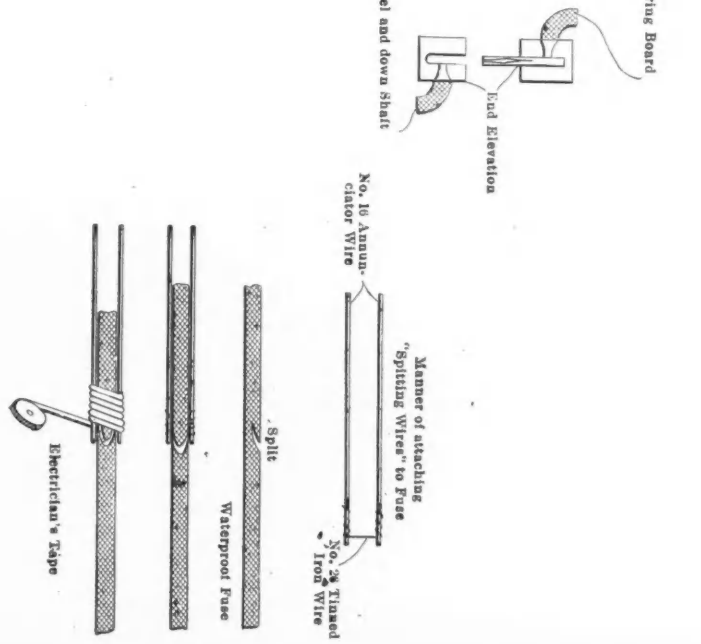
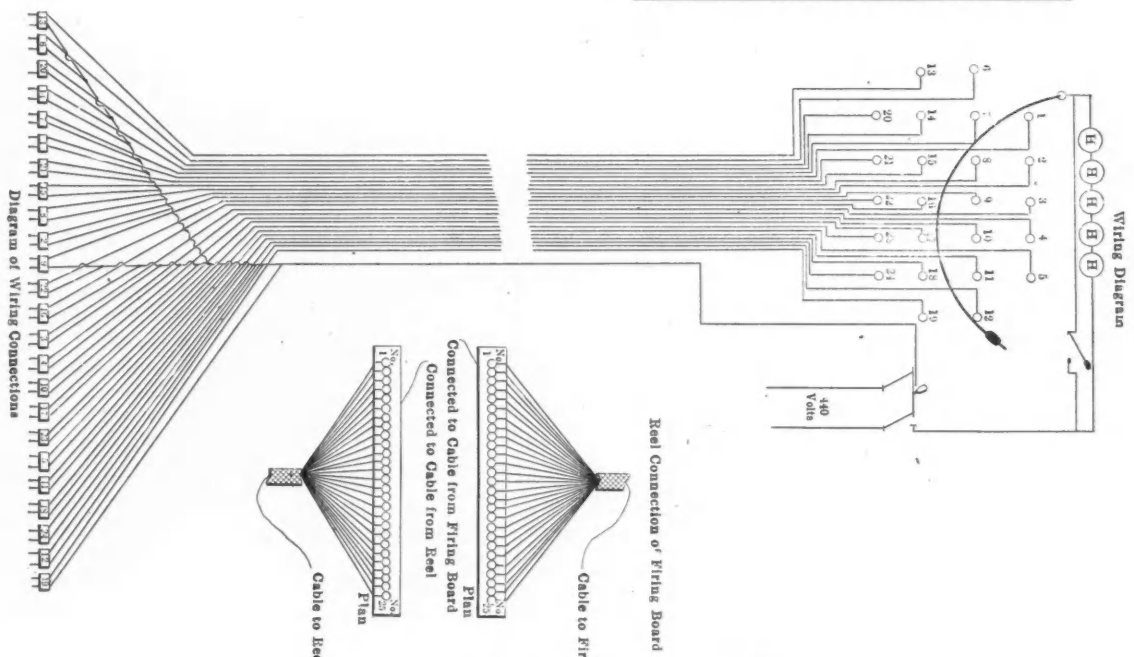
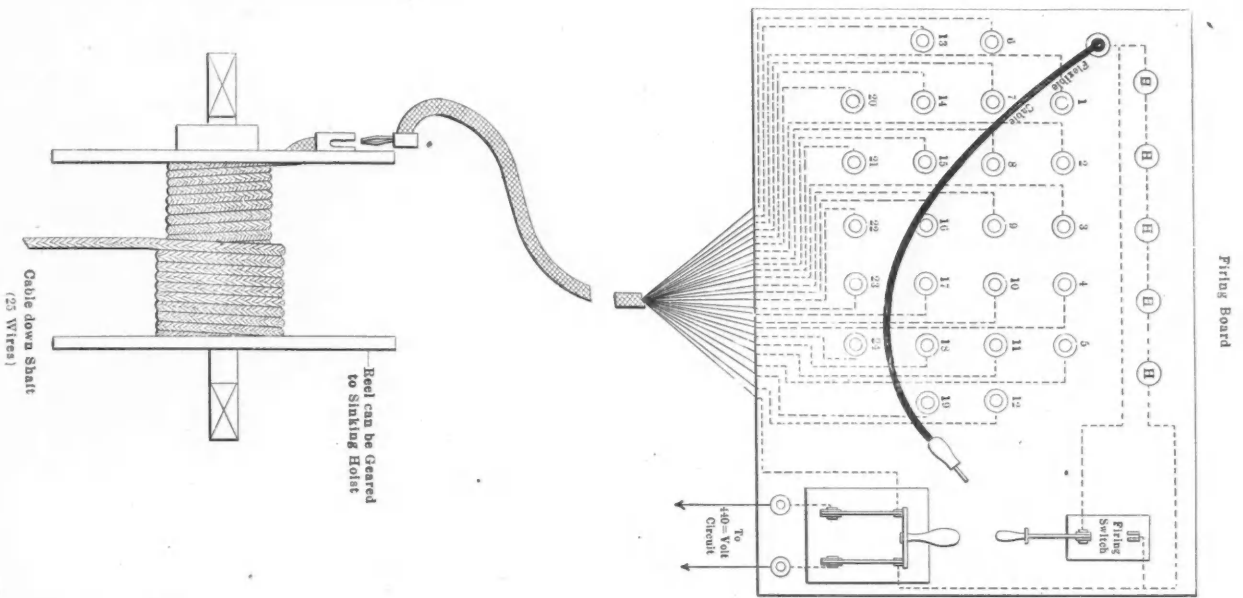
The operator then allows his time interval—a few seconds between holes—which in most cases is simply time enough to change his plug to the next hole. He then proceeds with the second hole as above described, re-testing the circuit-firing resistance to see if the operation was successful and continuing until all the holes are spit. The melting of the fuse wire leading to each hole disconnects the firing blocks so that the lower end of the cable is free, the upper end is then detached from the firing board, the cable wound onto the reel, and set aside until the next round. The fuses are all ignited and the shots go in the order desired without any attendant danger.

While seemingly complicated in description, this device can be cheaply installed where the current is available. In making this device nothing is required besides the ordinary material and apparatus kept at a mine where electric current is used for power. The original device was patented by one of the miners who was working in the shaft when it was used, but as neither of the inventors have taken out a patent, the perfected form is not covered by the stolen patent.

This device is as simple to operate as a telephone switch board, while the attaching of the firing blocks to the fuse takes little more time than would be required in spitting a fuse with a torch, and is quicker than spitting with a hot iron, but of course it is not speed that is important, but safety.

For lubricating engine bearings a free-running oil is said to be best.

*State Inspector of mines, Bolsé, Idaho.



DETAILS OF ELECTRIC DEVICE FOR FIRING HOLES IN SHAFTS

The Operation of Coal Cutting Machinery

A Technical Discussion of the Use and Economy of the Various Coal Cutters Showing the Advantages and Disadvantages of Each Type

BY GEORGE E. LYNCH*

The production of bituminous coal offers a field for the employment of machinery more favorable than that presented by any other class of mining. This has led to the development of highly specialized machines suitable for this work alone, and almost unknown to those whose operations are confined to the harder minerals.

While the difficulties and dangers encountered in producing coal are not, except when complicated by the presence of gas, any greater than those overcome by ore miners, the friable nature of the coal itself offers a better opportunity for machine mining and engineers have not been slow in taking advantage of this.

In most modern times, the coal is undercut and drilled for shooting down by electric or compressed-air machines, and hauled to the shaft bottom or tippie by electric or compressed air locomotives. In cases it is even loaded into cars underground by the same power.

The commercial machines of the present time may be divided roughly into two classes; the percussion or puncher type which imitates the action of a hand miner's pick, and the chain and cutter-bar machines which use the continuous cutting effect of a series of tools or picks working in a manner similar to a milling cutter in metal or a circular saw in wood.

THE PERCUSSION TYPE OF MACHINE

The puncher has proved a satisfactory machine in practice and is adapted for use in many places when the second type is nearly, if not quite, useless. Its mechanism is not unlike that of a small steam pump with the water cylinder omitted. The piston and rod are made heavy and are guided by an extension of the front cylinder head; the outer end of the rod is fitted with a taper socket or chuck adapted to hold a single, double-pointed pick. The machine is mounted on low wheels and furnished with a pair of handles at the rear end of the cylinder. The motive power is always compressed air, for there is, as yet, no practical electrically driven puncher on the market.

In use the puncher is placed on a sloping platform called the "board," the front end of which rests against the coal face, the rear end being elevated on a low trestle or "horse." The object of the slope is, of course, to overcome and neutralize the effect of the recoil at each stroke. The runner sits on the board back of his machine and blocks one wheel

with a wooden clog strapped to his foot, guiding the direction of each blow of the pick by the handles, already mentioned. A second man, called the "scraper," kneels on the floor by the board and keeps the cut clear with a long-handled shovel.

The completed undercut is about 6 ft. wide and 4 to 6 ft. deep, and is wedge-shaped in section, the height decreasing from about 18 or 20 in. at the face to 2 or 3 in. at the extreme depth. This wedge form of the undercut is very effective in causing the coal to roll over and break up when shot, rendering it easier to load.

The puncher with its board is shifted along the face about 6 ft. as each cut is finished until the whole place is undercut. In room and pillar work the miner usually starts at the corner of the room so that when the work is completed it is unnecessary to drag the machine and board over the accumulated slack and cuttings in shifting to the next place. Each puncher is supplied with a special low truck of a gage to fit the mine tracks upon which it is loaded with its board, coil of hose box of picks, etc., when moving about the mine.

THE DIFFERENT MAKES OF PUNCHER MACHINES

There are several makes of punchers on the market, all similar in outward appearance and efficiency and differing principally in the valve gear. All receive air through a large main valve which is in turn governed by a smaller auxiliary valve. In the Sullivan puncher, this auxiliary valve is driven directly from the main piston by means of a rifle bar with a pinion engaging a rack. A movable false seat under the auxiliary valve may be adjusted by the operator while the machine is running, thus advancing or retarding its stroke and consequently governing the movement of the main piston. In the Ingersoll-Rand, the Harrison, and other standard punchers, the auxiliary valve is moved by a small engine independent of the main piston, its action being under the control of the operator as in the previous case.

Each puncher, in the hands of an efficient runner, will average 60 to 70 ft. of face undercut per 10-hour shift. The power consumption is from 100 to 150 cu. ft. of free air compressed to 80-lb. gage per minute, thus giving a speed of about two strokes per second, which is regarded as the most economical rate of running.

Any higher speed tends to disconnect the runner so that he is unable to place each stroke to the best advantage. The working efficiency of a pick-machine plant is very low. After deducting losses due to the compressor, friction, pipe line, leakage, etc., the resulting power applied to the coal is rarely more than 12 per cent. of the horse-power supplied at the steam cylinder of the compressor.

A NEW TYPE OF CUTTER

A new type of percussion coal cutter has been introduced in the last few years which consists essentially of a rock drill mounted on a mining column and arranged to be swung in an arc across the face by means of a worm and sector. A series of steels of varying length, each carrying a bit of proper gage, are used just as in ordinary rock-drill work, except that instead of pounding away at one spot, this drill swings radially and cuts a groove 10 to 15 ft. long, advancing $\frac{3}{8}$ to $\frac{3}{4}$ in. each swing. Machines of this type have been successfully used abroad. These European machines, however, are provided with universal adjustment so that the drill may swing at any desired angle regardless of the setting of the column; this is a patented feature not used on those made in this country, since the latter are capable of a horizontal and a vertical swing only.

Coal cutters of this type may be used for shearing, when the coal will not stand undercutting, by setting the worm sector to swing in a vertical plane without any other change. When a room is cut, the machine may be clamped in place and the holes drilled for shooting with the same steels working as a rock drill.

The danger of a long cut closing and stopping the swing of the steel is a serious disadvantage with this machine. There is also considerable difficulty in holding a column up against a greasy surface of slate or roof coal, a trouble experienced even with the small power rotary drills and naturally much augmented by the repeated shocks of a percussion machine.

The Stanley header was designed to drive a complete gangway or tunnel at one cut. It consisted of a disk of large diameter rotated on a horizontal axis by a duplex air engine or an electric motor; the front face of the disk was provided with a number of cutting tools. The whole machine was mounted on a heavy truck and forced against the coal face. A conveyer was arranged to take the slack

*Mechanical engineer, Boston, Mass.

and cuttings to the rear where they were loaded into cars. This machine proved unsuitable for American conditions and is now practically obsolete.

Some attempts are being made at the present time to perfect a machine which will do the cutting and the loading at the same operation. These machines are, however, more or less experimental and it is as yet impossible to form any definite opinion of their capabilities.

One of the earliest continuous-cutting machines to obtain success was the old cutter-bar type now almost obsolete in this country, although still used to some extent in England. This machine employed a tapering bar of steel, of a length sufficient to give the proper depth of undercut, in which a number of picks or tools were set. The bar was rotated by a compressed air engine or an electric motor and cut the coal in a manner similar to a surface mill in working metal. The picks were arranged in a line along the bar with the object of clearing away the cuttings and preventing sticking by a sort of screw conveyer action.

While this machine was strong and simple in construction, it was found nearly impossible to maintain a level cut in irregular coal, as the bar was easily forced upward or downward by hard spots of sulphur or by "horse-backs" in the bottom and was with difficulty returned to the proper level. This led either to a set of broken picks when they encountered a limestone floor, or a job of taking up bottom where the bar had worked upward.

The disk-longwall machine was also popular for a time and is still used to some extent. This machine imitated the action of a circular saw, the cutting tools being mounted on the periphery of a large steel disk, set horizontally and driven by bevel gearing from an air engine or electric motor. The central bearing was made short and supported by steel plates above and below the disk so that almost the entire diameter was available for extending under the coal.

Since in longwall working some pressure and consequent settling of the coal is essential to easy shooting down, it is obvious that there was a continual pressure on the rearmost edge of the disk and that practically the whole active edge was required to work continuously after the cut had progressed a few yards. This caused a large consumption of power and a consequent low efficiency of the machine.

THE CHAIN COAL-CUTTER

The chain coal-cutter has been standard for a number of years and is used in practically every field in the country. There are two types adapted for room-and-pillar work, the chain-breast, and the so-called continuous-cutting machine, which is a modified longwall type.

The chain-breast machine is made up

of two essential parts; a stationary base or frame which rests on the floor, and is clamped down while the machine is running by jacks set obliquely at either end and bearing against the coal face and the roof respectively; and a movable triangular cutting frame carrying a chain, provided with picks or cutters, on sheave wheels at its angles. The motor or engine is fastened rigidly to the triangle at its apex, the base being presented to the coal. The frame with its motor travels in and out in guides on the stationary base or carriage, the feed being accomplished by a rack and pinion. A cut 30 to 40 in. wide and 5 to 7 ft. deep is made at each setting, the height of cut varying from 4 to 5½ in. according to the setting of the picks. The cutter frame is then withdrawn and the whole machine moved over by hand a distance equal to the width of the cut where the same procedure as before is followed, the operation being repeated until the entire face is undercut. The machine is then drawn away from the face and loaded on a special truck built for the purpose, ready to be moved to the next place.

Each chain-breast machine requires the services of two men, a machine runner and a helper, the latter keeping the cut clear of slack and assisting in moving and loading the machine. A skilful operator will undercut from 150 to 180 ft. of face per shift. The electric machines require about 12 kw., equal to 48 amp. at 250 volts, or 105 amp. at 115 volts, and the compressed-air machines about 400 cu. ft. of free air compressed to 80-lb. gage per minute when running at full power.

ADVANTAGES AND DISADVANTAGES

The advantages of this machine lie in the smaller number of men required to produce a given tonnage as compared with pick machines or hand labor, its greater mechanical efficiency, and the higher percentage of lump coal due to the low kerf or undercut which it makes.

Its disadvantages may be stated as the difficulty of obtaining a level floor, the necessity of placing all props 10 ft. to 14 ft. back from the face to allow of its working, the liability of pinching the wide cutter frame in any settling of the coal, and the labor involved in moving the machines by hand along the face after every cut.

To overcome these disadvantages the continuous-cutting machine was developed. There is at present but one of this type on the market, but it is probable that most other manufacturers will have machines running on this principle in the near future.

The continuous-cutter is essentially a longwall machine modified to adapt itself to room-and-pillar work. The cutter frame is narrow and carries a single sheave at either end, the construction otherwise is similar to that previously

described. In the starting or "tight" cut, the cutter frame is fed in as before, the feed being accomplished by a chain instead of a rack and pinion in the machine under discussion. The rear portion of the underframe is then detached, and the feed chain is extended the length of the face, and fastened securely at either end to a steel prop or jack provided for the purpose; the whole machine is drawn along the face, making a continuous undercut from end to end. At the further end of the room, the cutter frame is withdrawn, the detached portion of the underframe being replaced for the purpose, and the machine is then loaded on a truck as before described.

The fact that this coal-cutter traverses the width of the room with the cutter frame under the coal, allows the setting of props close to the face, since the space necessary for working is only that taken up by the motor and feed mechanism and this does not exceed 3 ft. in most cases.

Both this machine and the chain-breast type are usually provided with a sprocket wheel and chain or other mechanical connection with the axle of the truck so that they may be moved about the mine by their own power, the cutter chain drive being, of course, thrown out of action by some form of clutch.

POINTS TO CONSIDER

While the chain coal-cutter represents the highest development of the mining machine at the present time, it is by no means conceded that it is, necessarily, the form best suited to the work. The internal friction due to the large number of chain joints, and the sliding contact on the guides, all of which may be regarded as constantly under the coal, and consequently difficult to lubricate, causes a serious loss of mechanical efficiency. Indeed, those machines which employ a high speed chain waste more than 50 per cent. of the power supplied at the terminals of the motor or the throttle valve of the air engine in overcoming this internal loss.

Another serious difficulty is encountered when cutting in high seams, from the fact that the coal tends simply to settle down the height of the undercut, when shot, and does not roll over and break up as it does when cut with the puncher. This necessitates a second shot to break up the mass, and makes it almost as difficult as shooting off the solid in the first place.

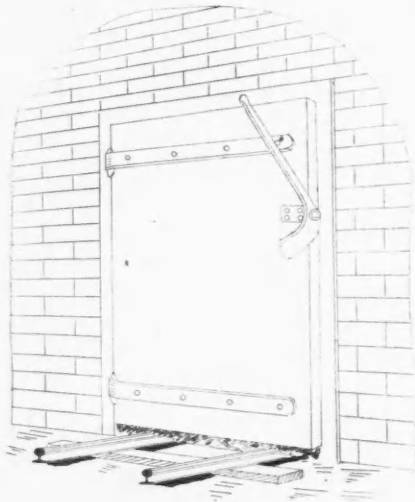
It is not impossible that we may be compelled to return to some modified form of the old cutter-bar machine to avoid these troubles. The bar itself could be built up of cast-steel skeleton sections to form a screw conveyer of a pronounced conical shape, the cutting tools being set on the edge, the whole assembled on a stout steel shaft. A steel frame attached to the body of the machine and traveling behind the bar in the undercut,

its form being similar to a longitudinal section of the bar itself, would assist in preserving the level of the cut. This frame could be inserted after the work had progressed a few yards, or could be attached rigidly to the machine, the latter construction necessitating a radial swing of the bar under the coal in starting and there leaving a corner uncut.

A coal-cutter of this type could be made very strong and simple in construction and the small number of bearings and rigidity of the mechanism should aid greatly in reducing the internal friction. The construction of such a machine would naturally introduce a number of problems which could be solved only by actual experience in cutting coal.

Door Opener

Glückauf, May 9, 1908, illustrates a simple contrivance by which to facilitate the opening of a door against a heavy air



ARRANGEMENT OF LEVER ON DOOR

pressure. As is well known, the tug always comes while opening a door the first few inches, after which, the air pressure having had a chance to become equalized, the door opens easily. A bent lever, formed as shown in the illustration, is pivoted to the edge of the door, its shorter arm pressing against the doorpost. This arm, although the shorter, is made sufficiently heavier than the other to insure its falling into position when released.

The Use of Compressed Air for Hoisting

Compressed-air hoisting engines should be fitted with extra large exhaust ports and pipes but should have small clearances, although the former may be dispensed with if the air to be used is reheated near the engine. A small amount of coke is all that is necessary for reheating, which prevents all danger of freezing besides effecting a decided saving. To ob-

tain the best results, reheat the air near the place where it is to be used. The pipe for conveying the reheated air from the heater to the cylinder should be covered as the loss of heat takes place rapidly. Live steam is a good reheater if available. Feed-water heaters give good results if the heating surface is ample and the air passage free. It has been estimated that $\frac{1}{8}$ lb. of coke per horse-power per hour will effect a raise in temperature of 366 deg. and cause a saving of from 25 to 35 per cent.

The greatest efficiency in a compressed-air hoisting plant is obtained where a central compressing plant can be used to drive a number of different sized hoists located far apart, and necessitating a separate supply of water and fuel for each hoist, if there is no central heating plant. Such boilers scattered about a mine are wasteful of fuel and usually do not give an efficiency of more than 3 or 4 lb. of water for each pound of coal burned, while a central boiler plant will average an efficiency of 8 or 10 lb. per pound of coal. A compressed-air engine at the central plant is ready for instant, continuous service at full speed. No time need be lost in working out water or quickening fires and there is no loss of steam when the hoist is stopped while the boiler fire is hot.

FOUNDATIONS FOR HOISTING ENGINES

Hoisting-engine foundations may be built of either brick, rubble, cut-stone masonry or concrete. The foundation excavation should be carried down below the frost line, to rock or firm gravel if possible. Never rest a part of the foundation on rock and the remainder on compressible soil, as such a foundation is certain to crack. If no good foundation soil or rock can be reached, use piling capped with concrete. When rock is not reached a sub-base of a minimum thickness of 8 in., made of one part cement, four parts sand, and eight parts broken stone, should be placed under the foundation proper to level the bottom and equalize the load. If stone is to be used for the foundation, the stones chosen should be as large as possible, and plenty of cement should be used. The anchor bolts should be long and well secured. It is also well to form an eye in the lower end of the bolt and insert an inverted T-rail; this will afford a firm fastening. Pass the rail through as many bolts as possible instead of using a washer and nut for each bolt. When the foundation has reached a suitable height, level it carefully so that the engine-bed plate will have a bearing at all points. Fill all openings between the bed plate and the foundation with cement.

When undercutting soft coal, all sprags used at the coal faces should be set with a tapered wedge of wood against the coal at the end of the sprag nearest the coal face.

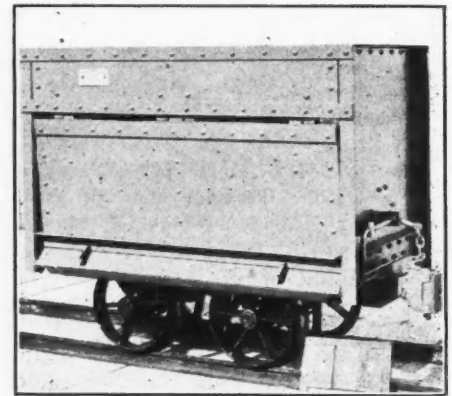
An Improved Mine Car

An order has been completed by the Arthur Koppel Company, of Koppel, Penn., for 200 mine cars for the Copper Queen Consolidated Company, Bisbee, Arizona. The cars were especially designed for this company, and have a capacity of 21 cu.ft. and a gage of 20 $\frac{1}{4}$ in. The side door and end plates are built of 3/16-in. steel, and the floor sheets of 1/4-in. steel. These plates are put together in such a way that all possibility of a strain on one point is eliminated.

The weight of the car complete is 1368 lb.; the over-all length of the car is 6 ft. 1 in.; over-all width, 2 ft. 8 in.; over-all height, 3 ft. 10 in. The general dimensions give a uniform and proportionate construction suitable for this kind of work.

The wheel base is 21 in., which allows the car to easily take curves having a 15-ft. radius. The wheels are spoke wheels of cast steel and are equipped with Siamese roller bearings, which reduce the traction power and lubricating expenses.

An important feature of the car is the



THE 21-IN. WHEEL BASE ALLOWS THE CAR TO TAKE CURVES HAVING A 15-FT. RADIUS

arrangement of the door-operating mechanism. This is operated by a trip located between the rails at any point on the line where it is desired to discharge the car. The mechanism is secured to the underframe, and is in no way connected to the floor of the car, which latter arrangement is the general practice on cars of this type.

The principal advantage of this arrangement is that there are no rivet heads or bolt heads on the inside face of the floor sheets to interfere with the discharge of the load. This was a requirement made by the Copper Queen Company, which has had considerable trouble with an obstructed floor sheet on other cars. The doors are automatically relocked when they fall into position after the load has been discharged. The whole design is simple and was put together with a view to durability and economy. All parts are riveted together, which lessens the chance of the cars becoming out of order through the slipping of nuts or screws.

The Variable Color of Coke Ashes

By W. P. YOUNG*

It is a matter of general knowledge, that the coke from any given region, having a somewhat similar analysis, gives normally an ash that is characteristic of that particular field, and even plant. It is not so well known that the color of coke ashes depends less on the chemical composition of the coal from which it is made, than upon the change in the chemical condition brought about by treatment of the coke as made and drawn, and to a certain extent, on conditions during the time of its later combustion.

I once had occasion, in conjunction with J. C. Brydon and L. C. McDowell, of West Virginia, to make numerous experiments in the line of the determination of the color of coke ash and its relative bearing on industrial problems, a resumé of which may be of interest.

Attention was first directed to this question by occasional complaints from consumers, especially from those using coke in open furnaces, that the coke had red ashes, and was high in sulphur, thereby injuring their product, as lead, for instance. As the normal color of the ash from coke made in the region in question is a light yellowish brown and very characteristic, it was at first thought the complaints were more or less justifiable; that the coke did really vary in its sulphur contents, and that the red-ash coke was higher in iron, and, consequently, in sulphur, inasmuch as nearly all the sulphur in the coke in question comes from its iron compound. Experiments carried on for quite a time, with cokes of varying sulphur contents, convinced us, however, that the varying color of the ashes was due to totally different causes, and that sulphur had nothing to do with the matter.

REGULATING THE SULPHUR CONTENT

The first point we determined was that the coke from any one oven (ordinary bee-hive oven) was practically uniform in its sulphur and iron contents, although we did find that the coke next the door was usually a little lower, say, two-hundredths of 1 per cent. than that from the rear of the oven, while coke from the center of the oven to the door was the lowest in sulphur. Usually, however, the difference did not exceed two- or three-hundredths.

We found that the sulphur contents did not vary between the bottom and top of the stands of coke more than a hundredth or two, in the event that the oven had been well burned, and had been good and hot on the preceding charge, as the amount of the sulphur left in the coke is determined largely by the treatment of the coal in the oven. If the oven is drawn after

the preceding charge in a good, hot condition and not drowned with water, the conditions for the making of a low sulphur coke are good.

The oven should be allowed to stand about one-half hour before recharging, in order that the heat from the interior of the brick is allowed to come through into the oven so as to cause the fresh coal to be fired quickly after charging. It was also found advisable to have the charge of slack coal in a moist condition as the steam given off in the hot oven assisted materially in carrying off the sulphur compounds. By carefully carrying out the above conditions we found we could burn off more of the total sulphur of the coal, thus leaving the lower sulphur coke.

AN INTERESTING EXPERIMENT

As it was believed that the color of the ash depended largely on the state of oxidation of the iron, both when the coke was made and when it was consumed afterward, a number of tests were made by treating the coke in various ways, with water and steam. A stand of coke from an oven just drawn very hot, which had been watered slowly, so as to allow for the greater part of the cooling to be made by the agency of steam instead of the water, was taken in a bright-red condition and one-half of it was immediately buried in dry sand, the other half being plunged into water.

Some of the samples above, after drying as stated, were wet with water, immediately placed in crucibles over a powerful blast lamp and burned as rapidly as possible. The ash in both samples was materially darkened, that from the sand-cooled sample being nearly, though not quite, as dark as the "normal" color for the region, while that from the quenched sample was a deep vermilion. This showed the same chemical change, though not to nearly the extent produced when the water was allowed to act on the red-hot coke.

VARIOUS METHODS OF WATERING THE COKE

Experiments were made by watering the coke in the ovens, with excess of water. This produced an ash much darker than the "normal," but not so deep a red as when the coke was plunged into water and thus immediately quenched. An experiment by using the hose on coke, drawn very hot from ovens, was also productive of dark ash.

After repeated experiments we found we could produce coke having an ash of almost any shade between the yellowish brown below the light brown "normal" and the vermilion mentioned above. It was altogether a matter of treatment with varying quantities of water at varying temperatures. The matter may be summarized as follows:

| CONDITION AS DRAWN. | CONDITION AS BURNED. | COLOR OF ASH. |
|--|----------------------|---------------------------------|
| Carefully watered in oven..... | Dried at 110 deg. C. | Light brown (normal). |
| As above watered in oven..... | Wet state..... | Darker brown. |
| Carefully watered in oven and exposed to heavy rain on yard..... | Dried..... | Darker, about as above. |
| As above..... | Wet state..... | Brown, with red tinge. |
| "Drowned" in oven..... | Dried..... | Red brown. |
| As above..... | Wet..... | Red. |
| Drawn hot, buried under water..... | Dried..... | Dark red. |
| As above..... | Wet..... | Vermilion. |
| Drawn hot, buried in dry sand until cold..... | Dried..... | Yellowish. |
| As above..... | Wet..... | Slightly lighter than "normal." |

After the lapse of some time, both samples were taken, dried and ground. They were then redried at 105 to 110 deg. C. for one hour, and were then burned in open crucibles. The ash from the sample cooled in the sand was somewhat lighter in color than the "normal" for the plant, being almost a yellow, tinged with light brown. The ash from the part of the sample plunged in the water was a dark red.

This showed that the total sulphur and iron contents had little to do with the color compared with the change in oxidation due to the treatment with water on the coke at red heat. Analysis showed the sulphur contents to be the same, or within the limits of experimental error, in the different samples. These results were repeatedly obtained by the same treatment, although I have noticed, at times, a lowering of the sulphur in the water-treated sample, the one having the red ash. This, however, may have been merely accidental, as it was only one-hundredth of one per cent.

The "normal" color would appear to be the result of the usual amount of water used in the ovens. It is usually quite uniform for a given plant, provided there is no great variation in the coal charged, or in the atmospheric conditions. The occurrence of heavy rains on the coke yard, while coke is hot from the ovens, will materially affect the color of the ash, as will also, in lesser degree, rain on the coke while it is in stock, either on the yards or stock piles at the consumer's plant. The fact of there being more or less moisture in the coke as burned, will to a certain extent, govern the color of the resultant ash.

With the exception of the coke that is buried in dry sand, the surface of which acquires a dingy appearance, the other cokes were similar in appearance, although a practiced eye could detect those having had the excess of water. However, an observer could not, from the appearance of the coke on the yard, determine with any degree of accuracy, what would be the color of the resultant ash.

*Superintendent of Inspections, Somerset Coal Company, Meyersdale, Penn.

Colliery Notes

Samples of coal when kept in carefully sealed vessels are subject to deterioration.

Using rails and water lines as the return for an electric current is a dangerous practice and should be avoided.

When using rescue apparatus supplying nearly pure oxygen, remember that oxygen acts as a poison at high pressure.

The roof, sides and foundations of underground rooms where electric machinery is installed should be constructed of fire-proof material.

Recent tests showed that the addition of pitch made it possible to coke some coals that, when tested, gave inferior coke, or no coke at all.

Coal loaded in box cars shrinks less than that loaded in open cars, as the latter presents a larger exposed surface to the drying action of the atmosphere.

In Continental mines when dangerous quantities of gas are present, gasolene locomotives, exhausting into water tanks are used successfully for haulage purposes.

Nearly two hundred different materials have been used for boiler cleaning purposes, but only four are effective: They are soda ash, caustic soda, tannin and kerosene.

In 1906, one of the larger anthracite companies pumped 24,437,000,000 gal. of water to the surface or more than 120,000,000 tons. A single pumping station sent up 3,000,000,000 gal. or 15,000,000 tons.

A blueprint of the mine, showing plainly the method of ventilation, the gangways and manways, roads, doors, etc., if hung up in some place near the colliery where the miners could familiarize themselves with it, might be the means of saving many lives in case of accident.

The part played by insects in the destruction of mine timbers is not often realized. A regular and thorough inspection against insect-infected timber should be a part of the routine work of all mines. Peeling timber soon after it is cut is an effective method of preservation against insect attacks.

In robbing pillars on the retreat from the boundary of a property, it is always best to keep the workings carefully in line, so that a larger proportion of lump coal will be won; undue weight on any one pillar is thus prevented, and the crushing of the coal as well as dangerous falls of rock are avoided.

The adoption by some of the Welsh collieries of an all-round eight-hour shift for fire bosses has had beneficial results so far as the safety of the miners is concerned and has materially reduced the number of accidents taking place. In one mine, only one fatal accident has occurred since this system was inaugurated.

The average consumption of coal by an ordinary reciprocating engine, is 5 lb. per horsepower produced; with the most improved types it is 2½ lb. per horsepower; internal-combustion engines are capable of operating on as little as 1¼ lb., while the most improved types consume a little less than one pound of coal per one horsepower.

In many European collieries, the whole length of hoisting rope is passed through a radial cleaning device once a month. Wire scratch brushes, arranged radially and pressed against the rope by springs are seated in a circular frame, which is free to rotate as the rope passes through it. This removes the grease and reveals any broken strands.

In Austrian mines, old winding and haulage ropes are used in tension to reinforce the roof timbers. The rope is cut in various lengths, is laid quite straight, and may be shaped to the timber if thought best, although this is not necessary. The roof pressure holds the ends fast when the weight comes on. Ropes used in this way prolong the life of the timber four-fold.

After an explosion has occurred and before beginning rescue work, ascertain the condition and direction of the air current. If the connections are broken, repair them temporarily and at once. Examine the current in the intake with an anemometer. If the fan is damaged beyond the possibility of a hasty working repair, turn live steam or exhaust steam into the outlet as far down as possible until ventilation is restored.

Ventilation is an important point in the life of mine timber. Poorly ventilated gangways and air passages with a fairly high temperature are favorable to decay, which is produced by bacteria, whose growth is caused by alternating wet and dry conditions or continued dampness. Decaying mine timber is also a fruitful source of danger to sound timber as the germs which produce the decay are easily contracted by the sound timbering.

Austrian mines are provided with underground rescue chambers. They are made to hold 50 men, being used as retreats in cases of danger. Each chamber is provided with all kinds of food, also water, first-aid supplies and individual rescue apparatus of the most modern type. Pure oxygen is laid down in pipes from the surface to the chambers. Storage-battery lamps are kept in these chambers and at intervals of 500 yd. along main roads.

Worm gearing used to reduce the speed from a motor to an endless rope drum gives good results, has few moving parts and is practically noiseless. Only machine-cut teeth should be used; these latter tend to increase the expense, but are positively necessary. The frictional loss of such gearing depends upon local circumstances;

it may be as low as 15 per cent., or as high as 70 per cent.; 50 per cent. is considered a good average. This frictional loss may be reduced by running the worm in an oil bath.

The Whitewood collieries, at Normantown, England, have a system of vacuum cleaning for removing coal dust, which they have found cheaper, and more effective than watering. The effect of wetting coal dust is only temporary, the dust soon dries and is finer and more dangerous than before, but the vacuum cleaner removes the fine coal bodily from the mine. Vacuum cleaning is also more thorough than any system of watering as it is capable of removing the large quantities of dust that accumulate above and on timbers and the dust which collects in cracks.

Concrete made of portland cement may be safely used in freezing weather, if 1 lb. of salt rock is mixed with every 18 gal. of mixing water, when the temperature is at 30 deg. F.; one additional ounce of salt is added for each degree of temperature below the above limit. This method of mixing has been found effective not only in preventing the freezing of concrete mixtures, but in addition affords a substantial aid to a more uniform setting of the whole mass. The heating of the water and pans used in mixing concrete also gives added protection against freezing.

Creosote in which timber is immersed for preservative treatment should be raised to a temperature of about 220 deg. F. Zinc-chloride solution should be raised to about 212 deg. F. In no case should the temperature be allowed to go above 240 deg. F. lest the fiber of the wood be injured or the strength of the timber decreased. After the bath is over, allow the timber to stand in the solution until it has cooled to 170 deg. or 140 deg. F. The length of time necessary for heating and cooling depends much upon the kind of timber used and the amount of seasoning; cooling also depends largely upon atmospheric conditions.

In the Compagnie de Bethune mining district of France the coal measures are covered by more recent rocks containing large quantities of water; these rocks consist of chalk supported by shales and clay. The amount of water contained in the numerous fissures makes the usual method of shaft sinking difficult and expensive, so the following method has been adopted with fair success: Previous to the actual excavation, four bore holes are put down at the corners of a square coinciding with the outside circle of the shaft. Into these bore holes is injected cement milk, which runs into the fissures. When the head of water is not sufficient, a force pump is employed to drive as much cement as possible into the ground. As high as 43 tons of cement are sometimes required to fill a single hole. Practically all the large fissures are sealed.

THE ENGINEERING AND MINING JOURNAL

Issued Weekly by the

Hill Publishing Company

JOHN A. HILL, Pres and Treas. ROBERT MCKEAN, Sec'y.
505 Pearl Street, New York.

London Office: 6 Bouverie Street, London, E. C., Eng.
CABLE ADDRESS "ENGINJOUR, N. Y."

Subscription, payable in advance, \$5.00 a year of 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii or the Philippines, \$6.50 in Canada.

To Foreign Countries, including postage, \$8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York office in every instance.

Advertising copy should reach New York office by Thursday, a week before date of issue.

For sale by all newsdealers generally.

Entered at New York Post Office as mail matter of the second class.

CIRCULATION STATEMENT

During 1907 we printed and circulated 507,500 copies of THE ENGINEERING AND MINING JOURNAL.

Our circulation for August, 1908, was 50,000 copies.

September 5..... 12,000
September 12..... 9,500

None sent free regularly, no back numbers.
Figures are live, net circulation.

Contents

PAGE

| | |
|---|-----|
| Editorials: | |
| American Smelting and Refining Company | 535 |
| Smelters' Troubles in California..... | 536 |
| An Important Coal Decision..... | 536 |
| Forest Fires..... | 536 |
| *The Shape of the Iron Blast Furnace. Henry M. Howe | 507 |
| Camp Bird, Ltd..... | 511 |
| Costs of Mining Quartz, Pyrite Gold Deposits..... James Ralph Finlay | 512 |
| The Cobalt Silver District, Ontario, Canada..... William B. Phillips | 518 |
| *Pachuca and Real del Monte Silver District..... Claude T. Rice | 519 |
| American Smelting and Refining Company | 526 |
| Magnalium, an Alloy of Aluminum and Magnesium | 526 |
| Short Talks on Mining Law—X. A. H. Ricketts | 527 |
| *A Selective Electric Fuse Spitting Device..... Robert N. Bell | 528 |
| The Operation of Coal-cutting Machinery..... George E. Lynch | 530 |
| *Door Opener..... | 532 |
| The Use of Compressed Air for Hoisting | 532 |
| *An Improved Mine Car..... | 532 |
| The Variable Color of Coke Ashes. W. P. Young | 533 |
| Colliery Notes..... | 534 |
| Correspondence: | |
| How to Sell a Mine. Allen H. Rogers | 537 |
| Cadmium as a By-product..Paul Speier | 538 |
| Multiple Arrangement of Drills on the Rand..... E. M. Weston | 538 |
| *Tailings Elevators on the Rand. Eustace Moriarty Weston | 539 |
| *Transvaal Mining Notes. Special Correspondence | 540 |
| Personals, Obituaries, Societies and Technical Schools..... | 541 |
| Special Correspondence..... | 542 |
| Mining News..... | 544 |
| Markets, etc..... | 550 |
| *Illustrated. | |

The American Smelting and Refining Company

The report of this company for the fiscal year ending April 30, 1908, which appeared just as we went to press last week, is especially unsatisfactory because it does not disclose the real position of the finances of the company, or show precisely how they were affected by the commercial depression coinciding with the last six months of the fiscal period. The previous history of the company has covered years of general prosperity, with a rising tendency in the prices for metals; it is important for the stockholders to understand the effect of adverse market conditions. The management of the company could, of course, throw full light upon this subject, but in the report to the stockholders it does not do so.

According to the report, the company earned the dividends paid on the common stock, but there was a surplus of only \$11,000 against upward of \$2,900,000 at the end of the previous fiscal year. The reduction of surplus corresponds substantially with the falling off in net income. However, the falling off in what the company called "net earnings" and also in gross earnings was nearly \$4,000,000. The comparatively better showing in the matter of net income is due to the failure of the company to pay anything on account of employees' profit-sharing fund, and also to a smaller appropriation than ordinarily for new construction and improvements. The latter account is of the nature of an allowance for amortization of plants, and it being doubtful whether the company on the average sets aside sufficient for this purpose, the smallness of the appropriation for the last fiscal year must be considered as postponing this charge against future profits.

The most surprising thing in the report is the insignificance in the falling off in metals account, which was \$18,251,587 on April 30, 1907, and \$17,519,664 on April 30, 1908. The actual status of this account depends upon the method of making the inventory. There are several ways of managing such an account, and it is easily possible to defer a settlement, which may show a profit or loss, according as later on the metals are sold at a price higher or lower than the inventory price. We are quite in the dark as to the method employed by the American Smelting and Re-

fining Company in this respect. In its liabilities it includes unearned treatment charges to the amount of \$2,068,506 against \$2,639,302 at the end of the previous fiscal year. This indicates a smaller amount of ore in stock. On the other hand, there was undoubtedly an increase in the stock of refined lead. However, in spite of that, it is difficult to understand why in view of the great decrease in prices for silver, copper and lead in 1907-1908 the metals account of the American Smelting and Refining Company fell off only \$731,923, unless it be that its metals have been uniformly inventoried at low prices. It has been gossiped that the policy of the company is conservative in this respect.

The president of the company is silent about this. He remarked that "the simultaneous and sudden decline in the value of lead, silver and copper, together with no proportionate decline in the expenses of operating mines * * * made it unprofitable for many of the various mines under contract to your company to continue their usual output of ore," and thus diminish the amount to be smelted, and consequently the treatment charges and gross earnings, but nothing is said here about losses on metals. Further on, in speaking of the American Smelters' Securities Company it is remarked that "there is a marked improvement at the present writing in the market value of copper and lead," recognizing that the prices for the metals have an effect on the smelting business, which, of course, is the case.

We are inclined to believe that the last report of the American Smelting and Refining Company is not so good as it looks at first sight, and that some of the adverse results may have been carried forward into the current year, with the hope that a rise in the prices for the metals will offset them. The fact that the credit to the profit and loss account of the American Smelters' Securities Company on May 31, 1908, was only \$33,709.32 does not look well. It brings the Smelting company upon the verge of having to pay the guaranteed dividends on the "B" preferred stock of the Securities company, but optimistically it is hoped that this will not be necessary. But even so, the last fiscal year has demonstrated the immense earning capacity of the Smelting company under unfavorable conditions.

There has been more or less comment respecting the holding of the stock of the

American Smelting and Refining Company as disclosed by the books at the time of the last annual meeting. The fact that the Guggenheims were nominally but small stockholders does not, of course, disclose how they really stand. We understand that the proxies in the hands of another important interest made a strong showing, but not enough to effect any change in the management, even if such were desired.

Smelters' Troubles in California

The opposition to the construction of any smelting plant on the shores of the bay of San Francisco seems to be gaining ground, and it is doubtful whether such plants can be completed and operated in the face of it. A large plant was planned at Point San Bruno, where ores, coke and other materials could be delivered by water, and a large sum of money was expended in the purchase of land, grading and building foundations, when work was stopped on account of opposition by the residents of Burlingame and other places near the smelter in San Mateo county. An organization was subsequently formed in Alameda county, on the opposite shore of the bay from the smelter site. Now, in order to secure coöperation, the Bay Counties Anti-Smelter Association has perfected a permanent organization in San Francisco, the expressed object being to prevent the building of a smelter on the bay shore south of San Francisco.

At the meeting where this association was formed, representatives were present from a number of cities and towns in the counties bordering on the bay, and it was decided to take aggressive action to prevent the completion of a smelting plant. Of course, the motive is the fear of injury to agriculture and of annoyance and damage to the towns by the fumes from the smelter. It is impossible to convince people that the smelting business can be so conducted as to prevent the spread of injurious fumes, and they are taking action to prevent its establishment at all; just as the people in the neighborhood of Benicia stopped work at the Selby plant by legal action.

The smelting companies evidently have a hard fight ahead of them in convincing these opponents that the smelting business may be carried on without injury to other interests. Like the Anti-Débris Association, which really killed the hydraulic-mining industry in the drainage

basins of the Sacramento and San Joaquin rivers, the anti-smelting party will be hard to convince contrary to first impressions. These persons are not in the slightest degree interested in the mining industry of the State and care little or nothing for its advancement or whether the closing of smelters will injure it; and they are indifferent to any industrial advantages which the operation of a large plant may bring locally.

An Important Coal Decision

An important legal case in connection with coal mining was decided by Judge Herndon of the Eighth West Virginia Judicial Circuit on Aug. 6, 1908. James G. Boyd, district mine inspector for the eleventh mining district of West Virginia, on May 26, 1908, reported to James W. Paul, chief mine inspector, that explosive gas was being generated in dangerous quantities in the mine of the Jed Coal and Coke Company, thereby rendering the mine unsafe and violating Section 14 of the mining law of West Virginia.

In accordance with said law, Mr. Paul immediately examined the mine and, finding that the mine generated dangerous quantities of explosive gas, ordered the mine officials to provide safety lamps for use in the workings, and abolish all naked lights underground. The mine officials refused to comply with this order, and Inspector Paul, in accordance with his powers as bestowed by the State Legislature, ordered that the mine be closed until safety lamps should be provided and used.

The Jed company immediately brought the case to a test and presented more than a dozen expert mine superintendents and engineers who testified that the mine was not sufficiently dangerous to necessitate the use of locked safety lamps. Chief Inspector Paul with two of his district inspectors appeared for the State, averring that careful investigations showed the mine to be exceedingly dangerous. Having heard the evidence, Judge Herndon directed that the mine be opened until he could give the testimony proper consideration. Seven weeks later he rendered a decision in favor of the Jed company, stating that the mine is in a sufficiently safe condition to permit, without unnecessary danger, the use of naked lights as heretofore.

There was, of course, no question of law involved in this case, but merely a

determination of fact, or rather the consensus of expert opinion. It is detrimental to the prestige of the mine inspectors to be reversed in this way, but at all events they will still feel that they have conscientiously done their duty.

Forest Fires

Two important mining districts have suffered severely this season from extensive forest fires. A few weeks ago we recorded the destruction of two important coal-mining towns in the Crow's Nest Pass district of British Columbia, accompanied by costly damage to mining plants. In the present week the western part of the Mesabi iron range in Minnesota is suffering from the same cause. Several smaller towns have been destroyed already, and the town of Hibbing, the largest and most important on the range, is fighting desperately to save itself from the fires which have almost surrounded it. In the Minnesota case no reports have yet been received of the damage done to mining plants, but it must have been considerable, as the fires have swept over a district where there are a number of such plants. Around Hibbing are several of the larger open-pit mines on the Mesabi, and fire there would probably do great damage.

The present season has been dry over a large part of the Northwest, and conditions have been favorable to the spread of forest fires. We do not hear, however, that any special measures have been taken to prevent them. It would seem to be prudent for mine-owners in districts like the Mesabi to take some precautions to prevent the start of fires, and to keep them from spreading. It would be much easier and less costly to do so, than to wait until the fires gain headway, and then try to fight them.

THE NEWS OF THE resumption of operations at the Great Falls smelter of the Boston & Montana company, and at the company's Mountain View and Pennsylvania mines at Butte, these mines furnishing employment for an additional 1000 miners, is gratifying. It will be remembered that on April 15 the flood from the Hauser lake dam washed out about 22 miles of track on the line of the Great Northern railway between Butte and Great Falls; pending the rebuilding of the track the Great Falls smelter was practically closed down.

Views, Suggestions and Experiences of Readers

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

CORRESPONDENCE AND DISCUSSION

How to Sell a Mine

The editorial on, "How to Sell a Mine," in the JOURNAL of Aug. 29, fails to treat of the subject in its entirety. As far as it goes, it covers the ground as to markets for mining property; but it seems to me that you have failed to note the most important requisite for successfully negotiating the sale of a mine. I speak from many years' experience both in New York and the City of Mexico, as engineer of one of the large exploration companies mentioned, as well as of concerns of smaller capital, and from the standpoint of the would-be investor. The man with a mine for sale fails to excite interest in his proposition by the general character or inconsistency of his statements, through ignorance, or by setting a prohibitive price on the property.

As you say, many of the large companies employ agents or scouts to look for mining property but it is not altogether because an insufficient number are brought to them. The principal reason is that hardly one in a hundred of the many proposals brought in gives information on points most important to the company's engineer. It would be amusing, if it were not generally so exasperating, to read the common type of report in these cases. Frequently long descriptions of scenery, climate and other general conditions constitute the major portion of the report. The acreage owned is always accentuated. The description of the mine and its workings occupies a subordinate position, while maps, if any are presented at all, generally show only the claims. An assay map, the most important feature of the report, is as rare as hen's teeth. Statements of width of ore, assays, tons developed, etc., are given in round numbers, usually not the result of measurement and calculation; and, where it is possible to check them up, they show wide discrepancies. Costs are generally utterly neglected and the value of "ore in sight" given is the gross value. In general it may be said that the economic, the business feature of the enterprise is entirely neglected; and since the investor's engineer can form no idea of this most important feature, he cannot advise his clients to spend several thousand dollars in the examination of the mine.

THE SORT OF INFORMATION NEEDED

Of course, in the case of a prospect all such data cannot be given but even then some data of economic value can be given. Most prospectors lose sight of the

fact that, in many cases, much information as to the distribution of the value may be obtained by exposing the vein by crosscut trenches at frequent intervals and taking samples and measuring widths. A man who can stake a claim should certainly be able to make a rough sketch-map showing the vein and the points where sampled, with assays and widths marked down.

But it is not to prospects, which are rarely brought in or considered by the development companies, that I refer particularly. Most propositions brought in for sale, in whole or in part, have had more or less development work performed on them, and in most cases some showing underground has been made. What the engineer to whom the data are referred wants to know is whether there is a reasonable chance of making a mine, the operation of which will return the money invested and leave a profit. While two men may differ as to what constitutes a reasonable chance, the data they require will always be the same and will consist of such information as the extent of the vein, its width or the width of the ore, the value it carries and the distribution; all of which may be embodied in an assay map. He further would want to get an idea of the composition of the ore, the cost of producing it, if ore has been produced, the cost of drifting and sinking, wages paid, etc., while data as to climate, topography, means of access, etc., are of interest only as they affect the cost of operations.

All this and other data are, of course, what go to make up a properly constituted engineer's report. If the investor's engineer, after consideration of the data presented, examines the mine, they are what he will gather himself to verify the vendor's statements. But if all these points are presented by the man seeking to interest capital and in such a way that the calculations going to make up the totals may be checked, he will find that his proposition gets much more attention than if he presents a rambling description containing hardly a figure. The vendor may have to employ an engineer to get up such a report and assay map but it will well repay him. There is no doubt in the world that a great many meritorious propositions fail to attract attention because of the indefinite and unbusiness-like way in which the facts regarding the property are presented.

WHAT IS A FAIR PRICE

A word as to prices. It would, of

course, be impossible to frame any general rule for the valuation of mining property. Some years ago, I heard one of our most successful mining investors quoted as saying that he would pay any time twice the net value in sight if the bottom of the mine looked good. But this is too general, and could be applied in only a limited number of cases. The price a man is willing to pay for a mining property is dependent on the risk of loss of his investment and on the profits he estimates can be made over and above the total cost of developing and equipping it to put it on a profit-paying basis. As one extreme, there is the promising prospect, i.e., a claim on which little work has been done. Here the risk is large, perhaps eight or ten to one, even when selecting prospects with discrimination. The value, therefore, is low. At the other extreme is the systematically developed mine with large tonnages blocked out, which needs only equipment to make it a dividend payer. Assuming that accurate estimates of the cost of equipping the property and of mining the ore are made, no risk attaches to the operation so far as the ore blocked out goes. But a developed mine usually sells for more than the net value of the ore blocked out on the assumption that more ore will be found in the extension of the deposit. The degree to which this is warranted must be determined by the purchaser, and this is the risk necessary to assume in a mine at this stage.

Between these two extremes lie mines in all stages of development. As the development increases the ore blocked out, so the risk decreases and the price increases. From these facts, it is natural, as generally occurs, that the great profit is not to the original locator nor to the purchaser of the developed mine but to the developer, the man who takes the prospect and makes a mine of it, whether he operates or sells the mine after development. As illustrating this point, the accompanying table may be taken as summarizing the history of a mine from the time of its location to its productive stage:

VALUE OF A MINE AT DIFFERENT STAGES OF DEVELOPMENT.

| Stage of Development. | Total Ft. Developed. | Net Value Ore Developed. | Net Value Probable Ore. | Value of Mine. |
|-----------------------|----------------------|--------------------------|-------------------------|----------------|
| Prospect | Trenching | | | \$2,000 |
| 1 year... | 300 | \$5,000 | \$50,000 | \$25,000 |
| 2 year... | 1300 | 50,000 | 200,000 | \$100,000 |
| 3 year... | 3000 | 250,000 | 500,000 | \$500,000 |

ALLEN H. ROGERS.

New York, Sept 1, 1908.

Cadmium as a By-product

The editorial in the JOURNAL of June 11, p. 92, describes the situation in the cadmium industry perfectly. The production is, however, larger than stated in that article. In the year 1907 the output in Upper Silesia reached 32,949 kg. as compared with 9840 kg. in 1897. Lately considerable cadmium has been produced, not as a product in the preparation of crude zinc, but as a by-product in purifying zinc solutions in the manufacture of lithophone. In the preparation of lithophone the impure zinc solutions are purified by boiling with zinc dust which precipitates foreign metals, chiefly cadmium, after iron and manganese have been removed. In a new process at Marienhütte the crude solutions are subjected to electrolysis in lead-lined tanks. For anodes plates or bars of metallic zinc suspended in the middle of the tank are used. The zinc dissolves in the neutral liquor while the foreign metals are deposited as a slime on the lead lining which serves as cathode. The electrolysis is complete as soon as a sample shows the absence of cadmium. This complete removal of cadmium also serves to prevent the development of a yellow tint in the finished lithophone.

At present residues containing cadmium are utilized in Germany as well as in Great Britain for the preparation of metal containing about 99.5 per cent. cadmium. Cadmium yellow is, however, also produced directly from the residues, which naturally also affects the consumption of the metal.

The price of American cadmium given in the JOURNAL, \$1.25 per lb., is rather high, for it is here offered at 6.75 marks per kg. Hamburg (about 70c. per lb.). Metal from the Silesian furnaces is held at about the same price. The price naturally varies with fluctuations in production and consumption. The market price of the metal is subject to marked fluctuations. In 1874 cadmium brought 15 to 16 marks per kg., while in 1884 the price had fallen to 8.50 and 9 marks. Between 1888 to 1893, quotations fell to 4 and 5 marks per kg. In April, 1896, the Government Feuerwerks-Laboratorien and the Konigl. Sachs Artillerie-Direction took considerable quantities out of the market for special purposes, so that at the end of December, 1897, the price had risen to 21 marks per kg. When the special demand ceased, a rapid decline occurred. The price varied between 5.50 marks and 6.50 marks per kg. until the close of 1905. In the beginning of 1905 active inquiry advanced quotations to 15 marks per kg., the high point of that year. The high price stimulated the manufacturers to increased production, which the consumption could not absorb. As stated above, quotations fell to 6.75 marks per kilogram.

PAUL SPEIER.

Breslau, Germany, July 22, 1908.

[The price that we give for cadmium in the United States is the quotation of the sole producer in this country.—EDITOR.]

Multiple Arrangement of Drills on the Rand

About a year ago, the JOURNAL published an article by E. M. Weston, of South Africa, entitled "Multiple Arrangement of Drills on the Rand." A letter from W. P. J. Dinsmoor, of Denver, comparing the work described in Mr. Weston's article with work in the Cripple Creek district (described in the May, 1907, issue of *Mine and Quarry*, under the title of "Western Practice in Tunnel Driving") was published in the JOURNAL of October 26, 1907. A copy of the letter, and of the May, 1907, issue of *Mine and Quarry*, were sent to Mr. Weston, requesting that he make such comment on them as seemed to him proper. I inclose herewith a copy of his reply.

This letter was submitted to Mr. Dinsmoor with the request that he make any further comment which might occur to him, in order to close the correspondence. In reply, he said: "I have read Mr. Weston's article with a great deal of interest, and appreciate the fact that conditions were different and until they were brought more closely together, no accurate comparison could be made, my comparison having been made on Mr. Weston's first letter, which did not give the complete details mentioned in his second letter."

S. BOWLES KING,

Editor *Mine and Quarry*.

Chicago, Ill., July 28, 1908.

E. M. WESTON'S LETTER TO MR. KING

The article on Western practice in tunnel driving in *Mine and Quarry*, May, 1907, explains several matters not clear to me in connection with Mr. Dinsmoor's letter.

Mr. Dinsmoor has endeavored to compare two entirely different things, and has naturally arrived at wrong conclusions. He compares a 9x9-ft. straight tunnel driven into the mountain side, provided with double tracks and mechanical haulage to within, say, 150 ft. of the face, the tunnel being also provided with a 15-in. blower pipe, with a drift along a lode which turns and twists every few yards. This drift was taken 5x6x7 ft. only, and was provided with a single track. (It was, I believe, the intention at the time to widen this drift later on to take a double track, as some extra haulage was expected along this drift connecting two deep shafts; but on nearly all the mines on the Rand, single tracks with sidings every 500 ft. are almost always put in for main drifts.) This drift was about 500 to 800 ft. in from the bottom of a shaft

4030 ft. deep and the trucks had to be run out all this distance by natives, and emptied, not into a bin but into a three-ton skip. Owing to the curvature of the drift it was practically impossible to carry in any blower pipe and the compressed air from the receiver was the only means of blowing out smoke. This smoke if blown away from the face when the drift becomes any considerable length, tends, owing to the bends in the drive, to hang about in it and often affects the trammers. The number of men per shift depends on the South African custom of having two natives per machine and one white man to supervise three or more machines. Owing to curves in the track, two natives are used to run out trucks while four natives shovel.

Now to turn to the question of rock hardness. Mr. Dinsmoor is of opinion that this cannot be much harder here than in the tunnel he mentions. I would remark that the Sullivan drill, which for some reason unknown to me, is not introduced in the Witwatersrand mines, may be a more efficient machine than others of the same class by different makers, but it can scarcely be so very much better as to make the difference between five holes and ten holes per shift. As a matter of fact the 15 holes in the face on the Rand were drilled in eight hours only, when the machines had been set up previously and then not always in that time. I am also told by miners from Cripple Creek that they could run their steel on $\frac{1}{8}$ in. difference of gage, whereas here $\frac{1}{4}$ in. in 18 in. is nearer the average. One 5 to 6 ft. dry-roof hole alone will take the best part of two hours to bore, and that with air pressure approaching 80 lb. at the face.

Sharp steel was always available in plenty so that I am afraid no other machine would have done much better. A certain amount of delay is caused by waiting for smoke to clear, and it is the usual custom to fire the cut first, for in tight ground it cannot always be depended on to come on the first firing. In the tunnel mentioned, the width of face allowed of a different and easier arrangement of holes that could all be blasted together. I might remark that had the tunnel been driven a full round of $5\frac{1}{2}$ to 7-ft. holes every eight hours, allowing the holes to have broken 5 ft., it could have been driven 465 ft. in a month instead of 375 ft. So we must conclude that even in this tunnel there were misfires and partially broken out holes, and that hitches and delays occurred in the work. I still wish to know what is the greatest footage driven in the deep levels of the mines of say Butte, Lake Superior and California of a true drive, along a lode that has twists and turns in it in really hard ground.

E. M. WESTON.

Brakpan, Transvaal, June 5, 1908.

Tailings Elevators on the Rand

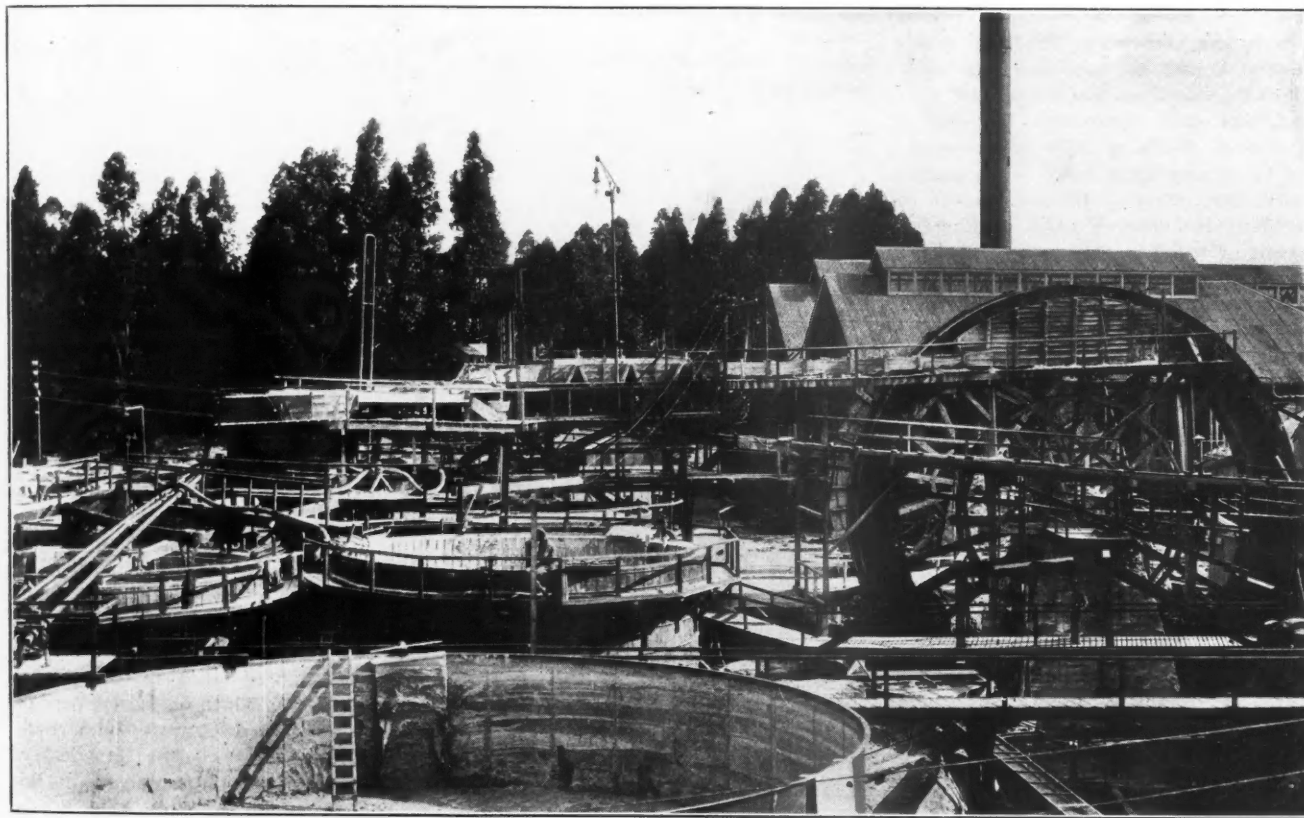
BY EUSTACE MORIARTY WESTON*

For many years, despite its high capital cost, the tailings wheel has reigned almost supreme on the Rand for raising water, sands and slimes from the foot of battery plates to the collecting vats of the cyanide plant and spitzluten. There were one or two Cornish lift sand pumps at work on the older mines or used as "stand-bys," but the tailings wheel was the standard type of elevator. Its supremacy has now been challenged on the score of high capital cost. A 30- or 40-ft. diameter wheel costs about \$8000 to install. Several alternative schemes have been tried of late years. In the plant erected

specific gravity of the whole so that an upward current is generated. The parts must be properly proportioned to give the maximum efficiency. The design of air inlet adopted for a 14- or 16-in. rising main is a ring of 12 one-inch holes placed 39 in. above the bottom of the foot-piece. Just above this is a small funnel-shaped enlargement of the pipe to give room for air expansion. The foot piece is a large bell mouth open at the bottom having about twice the diameter of the pipe. The ratio of submergence to lift is 1.8 to 1; air is used at $34\frac{1}{2}$ lb. per sq.in., and 2.4 cu.ft. of free air per cu.ft. of pulp is used. The efficiency estimated on the indicated horsepower of the air-compressor's steam cylinders is nearly 40 per cent., which compares favorably with that of a tailings wheel or pump.

the wheel. Two pumps, one to be kept as a stand-by, can be put in for \$1800 to do the work of an \$8000 tailings wheel. The life of a tailings wheel is 12 years here. What the life of a pump with renewable liners will be under the same conditions is unknown. The efficiency reached is 40 to 45 per cent. Personally I should be inclined to try what the efficiency of a properly designed jet elevator, as known to the hydraulic miner, would turn out to be. With an economical pump to produce the necessary pressure, it might be well worth trying, for nothing is simpler.

As indicative of returning confidence in the Rand, the *South African Mining Journal* (May 23, 1908) states that since the first of the year 40 new stamps and



TAILINGS WHEEL AT THE ROBINSON MINE, WITWATERSRAND, TRANSVAAL

on the Meyer & Charlton under the supervision of G. A. Denny, a vertical belt elevator was installed to lift tailings 70 ft. with a plunger sands pump as a stand-by. The sands pump has, however, proved most suitable for constant work.

In the new plants on the Angle & Cason mines on the east Rand, M. Wilson, the consulting mechanical engineer, has installed a modified form of the Pohle air lift for lifting the pulp from the battery. It consists of a plain pipe given the necessary submergence in water; at the bottom is fixed a bell mouth and compressed air inlets. The air mixes in the pipe with water, sand and slime, and reduces the

THE USE OF PUMPS

The mechanical engineer of H. Eckstein & Co., A. M. Robeson, has adopted an improved form of centrifugal pump to do this work, and it is now at work on the Rose Deep, Crown Deep, New Heriot and other mines.

About a year ago one of the ordinary types had to be put in at the Rose Deep owing to a breakdown. The manganese-steel liners wore out very quickly, and the pump capacity was insufficient. The design of the pump has been modified, and locally-made cast-iron liners have been put in rendering it more efficient and more easily and cheaply repaired. A great saving in capital cost is made compared with

three tube mills, equal to 67 stamps, had come into operation, and that there is now in course of erection, or under order, 700 new stamps and 45 tube mills, equivalent to an increased capacity of 1620 stamps. The following seven new producers are included among those ordering equipment: Simmer Deep, Jupiter, Knight Central, Main Reef West, Cinderella Deep, West Rand Consolidated and Geduld.

An authority on the subject states that a hot bearing may be caused by using an unsuitable alloy containing a large proportion of zinc; the only cure for this is to cast a new brass.

*Mining engineer, Brakpan, Transvaal.

Transvaal Mining Notes

SPECIAL CORRESPONDENCE

The latest encouraging news is the finding of the Main Reef on the East Rand, in the Brakpan shaft.¹ The high assays and the width of the reef make this a most important find for the eastern portion of the Witwatersrand.

OPERATIONS IN THE SOUTH RAND

The Nigel company, which has been paying dividends since 1889, and which, with the Nigel Deep, is the only gold-producer upon the Main Reef outside the Witwatersrand boundaries, has decided to extend its operations by the acquisition of a neighboring property—the Rand Nigel. This holding has been idle for 13 years. Active operations have, indeed, been so long confined to the richer shoots associated with the anticlinal fold upon which the Nigel and Nigel Deep are situated, that such expansion is particularly gratifying. Working costs on this southern lip of the Rand basin are comparatively high, owing to the small width of the flatly inclined reef; but working on a basis of 10,000 to 11,000 tons milled per month, for a \$93,000 yield, the Nigel has reduced expenses to \$5.30—a figure putting a new complexion on the prospects of the district.

COMPANY AMALGAMATIONS

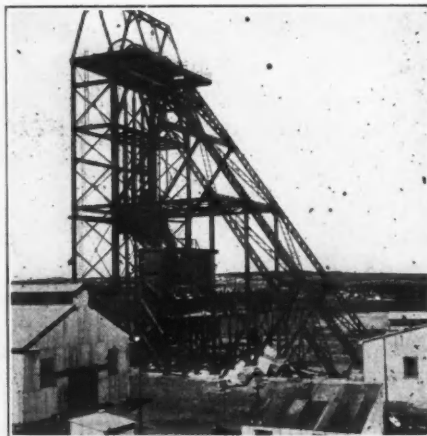
Amalgamations continue to be the order of the day, and no sooner is one batch of properties united than a new consolidation is placed under discussion. The most recently effected was that of the East Rand Proprietary subsidiaries—including the Angelo, Driefontein, New Comet and Cason, which, with 820 stamps employed, turned out in June nearly \$1,000,000. Awaiting shareholders' approval, is the amalgamation of the Turf Mines and Village Deep. A further centralization is talked of in connection with the Consolidated Main Reef and its subsidiaries, the Main Reef West, Main Reef Deep, and Main Reef East. Of greater interest will be the destined amalgamation of Eckstein properties, individually famous in the mining world, in the West Central Rand. This will involve, according to report, the Crown Reef, the Crown Deep, the Robinson Central Deep and the new South Rand. The Crown Deep and Robinson Central Deep work with a joint mill of 300 stamps and the Bonawya's old 55-stamp mill. The Crown Reef, now in its declining years, has a 120-stamp mill within 1500 ft. of the South Rand head-gear. Another feature linking the properties, apart from the primary one of similar financial controls, is the ready ability of the Crown Deep company to begin development on the South Rand

claims on the dip before the new vertical shaft—to be commenced shortly upon completion of the permanent steel head-gear—has been carried to the reef over 2000 ft. down.

The new South Rand shaft has seven compartments, and is being sunk on the dip of the Crown Deep. The steel head-gear, shown in the accompanying photograph, is of the latest type in use on the Witwatersrand.

DISCUSSING MINING METHODS

Not for many months has the Rand technical world been treated to a discussion upon mining methods and conditions of such warmth and stimulating influence as that now proceeding under the auspices of the Chemical, Metallurgical and Mining Society. A few months ago complaints were heard that the controversial spirit, once so cogent a factor and so essentially serviceable upon a field where lack of secrecy enables officials to discuss the practical details of their work unre-



STEEL HEAD GEAR, SOUTH RAND MINES

servedly, ceased to be in evidence; that the proceedings were becoming too tame to arouse the working members and draw them into an active debate. It merely required, however, some enterprising and imaginative member to present a few revolutionary ideas and to advance a few sharp criticisms of mining practice, to awaken the fighting spirit so normally characteristic of technical life at this altitude of 6000 ft. In the present instance, the starting point was a paper by Tom Johnson on Rand mining, raising a multitude of questions which have exercised the minds of managers from the earliest days. The main points upon which Mr. Johnson has evoked discussion have been his advocacy of circular shafts—tried long ago upon the Rand and found uneconomical; of endless rope haulage in moderate inclines underground; of a greater number of machines in each stope; of cheap hand-drilling steel; of boilers to be used underground; of stope-filling with sand residues; and of a greater number of white men in the mines. His criticisms also

touched on the common disposition of shafts and the alleged extravagant dimensions of new shafts for the duty they are designed to maintain.

After coming in for much healthy criticism at the hands of T. Lane Carter, E. M. Weston, C. B. Sauer and J. M. Phillips, Mr. Johnson found his ideas again pulled to pieces at a later meeting by practical men. Certainly he can find no support for his proposition to crowd a large number of machines (like hammer-boys) into a stope, it being a generally accepted axiom in Rand mining that the contractor must be allowed a long stopping face, for the two or three machines under his supervision, to enable him to work successive benches to best advantage. There is the supplementary difficulty—practically insuperable in the majority of cases, where all the broken rock has to be "lashed" from the faces to the boxes at the level—that the stope would speedily become choked with dirt and work impeded. In other words, the machines would beat the lashing boys, whose working space and capabilities are restricted by various factors. Mr. Johnson, in condemning the great seven-compartment shafts of today and citing hauling speeds which should enable 5000 tons per day to be raised through two compartments (excluding pump-way), called upon himself a storm of contradiction, to which he will have difficulty in replying. His allowances for the lowering and raising of the army of men and the tons of steel, explosives, etc., required for the breaking of the 5000 tons, and for the fact that hoisting must proceed in a Rand mine from several different levels, have been so hopelessly inadequate as to completely destroy the force of an argument which, stated in general terms, would have been sound in its application to certain mines.

The question of filling the mines with residues is one which is raised periodically, and disposed of finally with corresponding regularity. The practice of Kalgoorlie is sometimes quoted in this respect, no attention being paid to the primary circumstances governing the West Australian system, namely, that methods of working the great vertical orebodies necessitate the provision of some stope-filling as a support to the machine-men, and that the residues used have been, in the ordinary course of slime-treatment, thoroughly water-washed before dumping as waste.

The best all-round drill steel (W. E. Kimber, *Journ. Transvaal Inst. Mech. Eng.*, May, 1908) contains, according to the manufacturer's rating, 0.50 to 0.60 per cent. carbon, for this combines maximum toughness with a hard cutting edge. Milder and cheaper steel should be used for the shanks since it is cheaper, welds up to the cruciform easier, and is less liable to crystallize and break.

¹See ENGINEERING AND MINING JOURNAL, Aug. 8, pp. 290 and 294.

Personal

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

E. J. Yetter, of Denver, Colo., has been in the Kougarak country in Alaska.

C. M. Clark, of Los Angeles, Cal., has been examining mines in the Tonopah district.

Dr. Milton L. Hersey, of Montreal, has given \$10,000 to the Kingston, Ont., School of Mining.

A. W. Amphlett, of Tonopah, Nev., has gone to Nicaragua, to take charge of La Luz mill in that country.

Thomas Crago, of Laurium, Mich., has been examining mines in Gilpin county, Colo., during the past month.

Etienne A. Ritter, of Colorado Springs, Colo., has been making an examination of mines in Gilpin county, Colorado.

J. V. N. Dorr has returned to Denver, Colo., after spending several weeks in British Columbia on professional business.

F. A. Gardner has resigned his position as chief engineer of the Union Iron Works, San Francisco, to engage in business on his own account.

Leopold Zimmerman, of New York, and M. M. Johnson, of Salt Lake City, Utah, have been examining the United Rico mines, at Rico, Colorado.

Frank B. Aller, a graduate of the Colorado School of Mines, who has been for some years at Antofagasta, Chile, recently made a visit to Colorado.

H. S. Lefevre is now in Reno, Nev., having returned from a professional trip to Mexico and Central America. He expects to spend some time in Nevada.

Robert A. Wood, of London, England, has been in Goldfield, Nev., on his way to the Ubehebe district in Inyo county, Cal. to examine mines for English parties.

H. B. Morrow, electrical engineer for the Galena Iron Works, Galena, Ill., has accepted the position as instructor at the Wisconsin School of Mining at Platteville.

Robert McElvenney, superintendent of the lead works of the Tacoma Smelting Company at Tacoma, Wash., has been looking at various smelters in Colorado during the past month.

Alexander McKay, government geologist of New Zealand, has retired from service on account of his advanced age. He has been engaged in mining and geological work in New Zealand for 50 years.

A. A. Hassan, of New York, has gone to Cobalt, Ont., to examine several mines in the Cobalt and Larder Lake districts. After completing this work, he expects to spend several months exploring in Ontario and Quebec.

Charles A. Short has resigned the management of the Jennie Gold Mining Com-

pany, at Gold Springs, Utah, and has been succeeded by W. F. Odin, formerly with the Ophir Hill Mining Company, at Ophir, Utah.

Henry P. Lowe, of Denver, a well known mining engineer has been in Gilpin and Routt counties, Colo., with a party of English capitalists and engineers, looking at mining properties, with a view to investments.

J. H. Plummer, president of the Dominion Iron and Steel Company, is taking up his residence in Toronto, having purchased a house in the suburb of Rosedale. It is thought that this foreshadows his retirement from the presidency of the company.

Eugene A. Delaney, recently mining engineer for the Berwind-White Coal Mining Company, at Windber, Penn., has received an appointment in the technological branch of the United States Geographical Survey. He is now on duty at the fuel-testing plant at Pittsburg.

Obituary

F. J. Falkenback, chemist for the Goshen Iron Company, Goshen, Va., was drowned Aug. 26 while boating.

Eagleton Hanson, secretary of the Trenton Iron Company, Trenton, N. J., died at his home in that city Aug. 27, after five months' illness of heart disease. He was born in England in 1842 and had been with the Trenton Iron Company over 40 years.

George G. Blackwell died at Straidlands, England, Aug. 26, aged 66 years. He was well known as a metallurgist, who had for many years devoted his attention to the rarer metals and their uses. He was the founder and head of the firm of George G. Blackwell, Sons & Co., of Liverpool, extensive dealers in minerals, ores and alloys.

Societies and Technical Schools

Association of American Portland Cement Manufacturers—The quarterly meeting of this association will be held at Detroit, Mich., Sept. 14, 15 and 16. Headquarters will be at the Hotel Pontchartrain. The executive committee will meet Sept. 14, and on Sept. 15 the business meeting will be held. On Sept. 15 there will be meetings for the reading and discussion of papers, and the meeting will close with a dinner in the evening.

Nova Scotia Coal-mining Schools—The results of this year's examinations for coal-mine managers, underground managers, overmen and enginemen in connection with the coal-mining schools, reorganized last year under control of the new Department of Technical Education of Nova Scotia, have been satisfactory. There were 27 managers, 35 underground mana-

gers and 17 overmen passed this year, being a large increase over 1907. The teachers are all practical men who have worked at coal mining. The regular coal-mining instructors all hold managers' certificates.

Iron and Steel Institute—The autumn meeting will be held at Middlesbrough, England, Sept. 29-Oct. 2. The local arrangements include visits to a number of furnaces, mills and other points of interest in the district.

The following papers have been offered for reading:

1. On the Scientific Control of Fuel Supply. By Prof. H. E. Armstrong, London.
2. On Metallurgy at the Franco-British Exhibition. By H. Bauerman.
3. On Gas Producer Practice. By Prof. W. A. Bone, Leeds, and R. V. Wheeler, Normanton.
4. On the Constitution of Carbon Steels. By Prof. E. D. Campbell, Ann Arbor, Mich.
5. On the Freezing Point of Iron. By Prof. H. C. H. Carpenter, Manchester.
6. On the Production of Finished Iron Sheets and Tubes in One Operation. By S. O. Cowper-Coles, London.
7. On the Chemical Control of the Basic Open-Hearth Process. By Alfred Harrison, Warrington, and R. V. Wheeler, Normanton.
8. On the Mechanical Cleaning of Iron Ores. By T. C. Hutchinson, Middlesbrough.

Canadian Mining Institute—The members and visitors of the Canadian Mining Institute visited the plant of the Nova Scotia Steel and Coal Company, at Sydney Mines, N. S., on Aug. 28, and were shown through the works by President R. E. Harris, General Manager Thomas Cantley, and Superintendent John Johnston. The plant was in full operation and the visitors had an opportunity of observing the processes in use. They were the guests of the company at luncheon at the Eastern Club, North Sydney, among those present being Lieutenant-Governor Fraser, of Nova Scotia; James Ross, president of the Dominion Coal Company, and H. E. Burchell, manager of the Sydney Cement Company. Professor F. H. Sexton, on behalf of the Nova Scotia Mining Society, expressed thanks for the entertainment afforded them. They returned to Sydney in the yacht of President James Ross and attended a garden party given at the residence of J. K. L. Ross. Subsequently the excursionists visited the Acadia Coal Company's colliery at Stellarton, N. S.; the asbestos mines near Thetford, Quebec, and the Canadian Chrome Company's plant at Black Lake. They were entertained at Montreal on Sept. 2 by the local committee. Sept. 3 was spent at Niagara Falls, the party leaving the same evening for Cobalt and Sudbury.

Special Correspondence from Mining Centers

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

REVIEWS OF IMPORTANT EVENTS

San Francisco

Sept. 4—The miners of California are fervently wishing for early fall rains which may replenish the streams and furnish a water supply for their operations. The summer has been an exceptionally hot one and the streams and springs in the mountains have run low earlier than usual. There has been an unusual evaporation in the reservoirs, ditches, flumes, etc., with the result that by the middle of August the scarcity of water began to make itself unpleasantly manifest. There has been no rain since last April, and the snow supply in the higher mountains, the melting of which is expected to keep the upper rivers and smaller streams flowing during the long dry California summer is lighter than usual. The result of all this has been that the water supply for mining purposes has almost given out and the mines cannot reasonably expect any heavy rainfall before November. The complaint about light water supply is confined to no particular locality, but is general. The gravel miners throughout the State suffered from a short water season, and many were unable to run their properties for more than a few weeks, instead of for several months as expected. The quartz mines have only now commenced to feel the effects of the water situation. Numerous active producers in the leading mining counties have been recently forced to curtail or entirely suspend operations. Even in the Grass Valley district, where the water lasts longer than at most mining centers by reason of the extensive ditch and reservoir systems the water has now run low. This scarcity of water has, of course, also interfered with the generation of electric power for mining and other purposes. One effect of this has been to bring to the front the idea of using gasoline engines for power at mills, to tide over the situation until the rains come. At the more prominent mines, they have auxiliary steam-power plants for this purpose. At smaller ones, gasoline engines are now being put in at a number of mines in the mountain and foothill regions.

Salt Lake City

Sept. 4—The Utah-United Copper Company was formed here last week to take over the properties of the Skylark Copper Mining and Milling and the Wasatch Mining and Milling companies, in the Beaver Lake mining district, Beaver county. A strong syndicate of Salt Lake

mining and business men has taken hold of the enterprise and proposes to open the properties on an elaborate scale.

The output of copper from Utah mines and smelters in August aggregated about 8,000,000 lb.: the Garfield plant of the American Smelters Securities Company, nearly 6,800,000 lb.; Yampa, 750,000 lb., and the Independent smelter at Ogden, 15,000 lb., the latter being in the form of matte. The Boston Consolidated Mining Company has been operating four units of its new Garfield mill, but the concentrate produced is held for later shipment to the smelter, owing to the difficulty experienced at Garfield in treating the concentrate derived from the Bingham porphyry ores. Since the installation of new equipment, costing \$200,000, and which includes a converter plant, the Yampa Smelting company is producing 30,000 lb. of blister copper daily. The product is of a good grade, containing \$175 worth of gold and silver to the ton and grading at about 98.5 per cent. copper.

The North Utah Mining Company has been organized in London to take over the properties of the Utah Development, Butler-Liberal and other Bingham companies. It has been announced that a fund of \$250,000 has been provided to be used in the purchase of equipment and for exploitation purposes.

Copper ore, worth \$300,000, in the form of concentrate, is piled up at the Garfield mill of the Boston Consolidated Mining Company, awaiting shipment to the smelter. For the reason that there is a lack of furnace capacity at the Garfield smelter of the American Smelters Securities Company, with which the mining company has a contract, the product is being withheld. In the meantime, however, the Boston company is operating its plant; the smelting company making advances on the ore in storage. The Boston mill has been treating daily during August between 800 and 900 tons of the porphyry ores from its Bingham mine, with four units of the plant in commission. Four more are ready and will be in service by the middle of September, or October 1. The ore shipped to the mill in August has averaged 1.7 per cent. copper, making a concentrate assaying from 20 to 22 per cent. copper. An extraction of about 71 per cent. has been maintained, while the milling costs have been reduced to about 50c. per ton. With additional units in service, the management expects to bring the costs down to 35c. per ton.

A special meeting of shareholders of the South Columbus Mining Company has been called for September 15, when the matter of increasing the capital stock from 300,000 to 500,000 shares will receive consideration. It is proposed to purchase the Wedge, a valuable property adjoining, all located in the camp of Alta.

Butte

Sept. 3—The Boston & Montana smelter at Great Falls partially resumed operations the first part of the week, and it is expected that in another week the plant will be working at its full capacity of about 3500 tons daily. The ore from the Boston & Montana mines, which for the past three months has been sent to the Washoe smelter at Anaconda, will now go to Great Falls. After an idleness of three months the company's Mountain View mine has resumed operations, and the Pennsylvania, shut down while the shaft was being retimbered, will resume the first of next week. With all the mines of the Boston & Montana company working at their full capacity, there will be employment for an additional 1000 men in Butte.

The North Butte Extension Copper Mining Company has been made defendant in two attachment suits within the past week. The National Mining and Investment Company, a brokerage concern of Butte, has brought suit for \$3,446.60 for money alleged to have been paid out for the benefit of the mining company. Geoffrey A. Lauzier is suing the company to recover \$5400 alleged to be due him for services as general manager of the company from March, 1907, to August, 1908.

The first meeting of creditors of the Butte Central and Boston Copper Company, bankrupt, was held Monday. The claim presented at that time amounted to \$158,000. Inasmuch as a number of the claims are to be contested by the various creditors, the meeting was continued until Sept. 12, at which time it is expected that a trustee will be decided upon.

A new building has been erected at the Montana State School of Mines, Butte, for ore-reduction purposes. The machinery and apparatus, consisting of Wilfley tables, calcining and reverberatory furnaces, a cyanide plant, and a stamp mill, are now being installed. When completed it will constitute the best equipped smelting department of any mining school in the West. Horace J. Stevens, of Houghton, Michigan, editor of the

"Copper Handbook," spent several days in Butte last week. He examined a number of the more important mines in the camp, particularly that of the North Butte company. He also visited the Washoe smelter at Anaconda.

Denver

Sept. 5—In the Cripple Creek district, the Portland mine is credited with having paid the largest amount in dividends of any mine in the State, the total sum being in round numbers \$8,000,000. This mine was located in 1892 by Burns, Harman & Doyle, and was only a small claim. The early proceeds of the mine, however, paid for the 200 acres which were subsequently acquired, and on which the company was organized with a capital of \$3,000,000. The mine also paid for the whole of the plant, which includes a big mill.

The Camp Bird gold mine in the San Juan region of Colorado is said to have paid nearly \$4,500,000 in dividends. This mine was discovered by W. Weston and George Barber in 1877, and was then known as the Gertrude and Una, two claims on the same vein. The latter was deeded by them to H. W. Reed in consideration of his driving a crosscut tunnel to intersect the vein at a depth of 150 ft. below the surface. The Gertrude was sold to the Allied Mines Company, of Quincy, Ill., with five other claims, for \$40,000 in 1881. This company was wrecked by its president, and later its claims, which included the Gertrude, were picked up by Thomas F. Walsh, chiefly, it is said, on tax titles, and rechristened the "Camp Bird," the Una and other adjoining claims being acquired by purchase, and included under that name. A small streak of rich telluride ore which had been overlooked by the Allied Mines Company led to the subsequent discovery of the bonanza ore.

The most important development work in Colorado today is the Roosevelt tunnel, projected for the deep drainage of the Cripple Creek mining district. The tunnel has now reached a total distance from the portal of 3173 ft., and this is being increased at the rate of about 300 ft. per month; but inasmuch as the shaft has now reached the tunnel horizon, two faces will be started immediately from this intermediate shaft, when a total monthly average of about 1000 ft. is expected to be made. If this rapid advance is achieved, the deep drainage tunnel will be completed at the estimated time, and the district drained nearly 1000 ft. below the present water level, and while the veins may not continue to carry their surface richness to such a depth, the elimination of pumping, together with lower rates of freight and treatment, will enable ore of a much lower grade to be mined and a substantial profit realized, so that one is safe in predicting that the Roosevelt drainage tunnel will add at least a quarter of a century to the life of the Cripple

Creek district. Meanwhile the output for August is reported at 66,886 tons of gold ore, of \$1,329,444 gross value.

The Elkton mine, which fell from its high estate in the effort to pump out the Cripple Creek basin, has for some years been worked in a quiet way, and paid regular dividends. Lately, however, the resumption of pumping in the Portland and Strong mines has lowered the water so that the bottom level of the Elkton is now dry, and the company is doing no pumping whatever. Some parallel lodes have also been discovered, and the property is looking better than it has for several years past, and is making a larger output. Production was suspended for the greater part of August, on account of the necessity of retimbering the first 100 ft. of the shaft. This work is now completed, and the mine operations are in full swing.

Considerable friendly rivalry is being indulged in between Denver and Salt Lake City in the endeavor to secure the building for the Mining Temple, which will form the permanent home of the American Mining Congress. The Salt Lake people are showing much energy and liberality to obtain the building for their city, knowing that it will attract mining men from all over the United States to the various congresses, which would naturally result in great benefit to them, and attract universal attention to the ore deposits of Utah. The Denver citizens, however, are showing their usual apathy in this important matter, and unless they promptly wake up to the full realization of the situation that confronts them, the Mormon Temple will have a rival in the Mining Temple to be built later in the city of the Saints.

The Portland Gold Mining Company, of the Cripple Creek district, is building an experimental mill at the mine. It will be the Clancy process, a modification of the cyanide process. Tests will be made on the low-grade ores of the mine and also on the dump ore; that is, on those ores which have proved too low-grade to be treated in the company's chlorination mill in the valley. In this connection, it must be remembered that the Portland company has one of the largest chlorination mills in this State, its capacity being about 10,000 tons per month, and it has been and is now, kept busy on the ores from that great mine.

On the Half Moon mine, of Gold Hill, Cripple Creek, by the caving-in of an old stope, it is said that thousands of tons of milling ore were exposed.

Up to date the Red Mountain district, between Ouray and Silverton, has been comparatively quiet, awaiting the resumption of operations on the properties of the Red Mountain Railway and Mining Company, which has been closed since the financial squeeze of October last. It is now stated that the manager has returned from the East, paid up all obligations and sent up a large force of men to continue

driving two long transportation and mining tunnels which are already in several thousand feet, and also to sink the shaft of the once famous Yankee Girl mine.

Toronto, Ont.

Sept. 7—The Bonanza Creek Mining Company, of the Yukon Territory, has brought suit against the Canadian government for \$17,600,000 damages for the cancellation of a concession which the company secured. The company claims that not only was it given a title to the ground but was granted water rights of a valuable character which were afterwards wrongfully annulled.

A number of prospectors are going into the region around Sturgeon lake and numerous good finds are reported. It is anticipated that with the completion of the Grand Trunk Pacific Railway which will facilitate communication active development will be begun. Spencer Bannerman brought in to Port Arthur a few days ago a 5-lb. sample of ore from the district, showing chalcopryite, bornite and gold. The find was made on the Northeast bay of Surgeon lake.

The long standing litigation over the claims of E. C. Hargreaves, of Bay City, Mich., and the White Silver Mining Company to three locations in Coleman township, that comprise about 145 acres, has been settled. The suit was brought by the attorney-general of Ontario, to set aside the leases granted to the defendants, at the instance of James McKay and James G. McMillan, who asserted that there had been no valuable discoveries made before location. The hearing of the case occupied ten days, and on June 25, 1906, judgment was given to the effect that the Government might cancel the leases upon indemnifying the holders for their expenditures in developing the property. An appeal was taken and has since been pending. By the settlement just arrived at the property is to be held by E. R. C. Clarkson, as trustee for E. C. Hargreaves, William F. White, James McKay and James G. McMillan, and the Government is to receive a royalty of 25 per cent. on the gross output of the mine. Mr. Hargreaves had expended \$40,000 in development work before the litigation compelled him to suspend operations.

A board of conciliation as provided for by the Lemieux Act has been appointed to act in settling the dispute between the Standard Mining Company of Cobalt and its men as regards hours and wages. The board consists of John A. Ewan, chairman, C. B. Duke, representing the miners, and C. E. Fraleck for the company.

F. H. Sherman, president of the local of the United Mine Workers at Fernie, B. C., has forwarded an appeal to the Trades and Labor Congress of Canada asking for assistance for 524 miners, 284 women and 814 left homeless by the recent fire.

Mining News from All Parts of the World

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

THE CURRENT HISTORY OF MINING

California

AMADOR COUNTY

Bright—Work has commenced in unwatering this mine at Jackson so it may be inspected by Nevada men who have it under bond. Andrew Noce is superintendent. The mine is also known as the Bellwether.

Valparaiso—This pocket mine continues to yield high-grade ore in small quantities, some of it going as high as \$3 per pound.

BUTTE COUNTY

Francisco—At this mine, near Enterprise, a 20-stamp mill is to be built to work the ore from the orebody recently discovered.

CALAVERAS COUNTY

Brunner—This mine at Angels has been bonded by M. L. Eppinger, of Blair, Nevada.

Boston Consolidated—Work has been commenced on this mine at Mokelumne Hill under superintendence of A. G. Keeler. The 30-stamp mill is being repaired.

Black Metal—This mine on the Gobbi ranch is being examined for John Heisner, of San Francisco, with a view to purchase.

Calaveras Consolidated—This Oakland company has been organized to work the General Grant group of claims at Mountain ranch.

Peek Ranch and Deep Gulch—These properties near San Andreas, consisting of 240 acres of patented land, have been bonded to George Calahan, of Santa Rosa, who is organizing a company to work them.

EL DORADO COUNTY

Spanish Dry Diggings—At this place, near Greenwood, the Nevada, Washoe, Choctaw, Chickasaw and Concordia claims are being prospected by means of an extensive tunnel. The work is being done by members of the Monitor Mining Company.

Sale—The Joe Delwisch and Jimmy Breedlove claims of T. H. Fowlar have been sold to Los Angeles men, and W. H. Hartwig has been placed in charge of development work.

INYO COUNTY

Casa Diablo Mining Company—This company is about to add to its equipment an air compressor, with machine drills,

cyanide tanks and slime savers. A winze has been started on the Dawn of Hope mine.

MARIPOSA COUNTY

North Fork—In this district, Samuel Harris is developing the Moonlight or Derrick mine in this district, with George De Sallier as manager. A number of other mines are under bond to Mr. Harris and a mill is to be erected.

Virginia—This old mine near Coulterville, John McLean manager, is sending fair grade ore to the 10-stamp mill, which is run night and day by electric power.

NEVADA COUNTY

Birchville Mining Company—This company, operating near Graniteville, has made a strike of considerable importance in the old Birchville mine, which was a large producer years ago.

Brunswick—In this mine, C. H. Mallen superintendent, considerable good ore is exposed in the lower workings and recent developments have opened several promising pay shoots. The sinking of a new working shaft is contemplated.

Kenosha—At this mine, G. W. Root, manager, the rich ore shoot opened on the 200- and 300-ft. levels has again been cut, and a great deal of high-grade ore is being taken out.

Norambagua—This mine, near Grass Valley, has been placed under bond to a capitalist, represented by Samuel Colt, who will at once develop it extensively. The mine was formerly a large producer.

PLACER COUNTY

Big Jim—Alfred Dixon has applied to the California Débris Commission for a permit to mine this property near Michigan Bluff by hydraulic process.

PLUMAS COUNTY

Arcadia—This mine, owned by D. McIntyre, has been bonded to W. G. Devereux and W. H. Mader, of Colorado, who will at once begin the work of exploration and development.

Castle Rock—Many nuggets are being taken from the lower tunnel of this mine at Nelson Point, owned by E. G. Lindsay and others.

SAN BERNARDINO COUNTY

Ibis Mountains—In this region, west of Needles, a large amount of mineral land has been taken up as the result of copper and gold strikes made this spring. As

soon as cool weather comes, considerable development work will be undertaken.

SAN DIEGO COUNTY

Cleveland Pacific Mining Company—The five-stamp mill of this company at Escondido has been started up on ore from the Grace shaft. The ore product of the Leonard & Stammer lease will soon be milled.

SHASTA COUNTY

Greenhorn—This copper mine, French gulch district, has again been bonded by the Bully Hill Mining and Smelting Company, which did some work on the property three years ago.

SIERRA COUNTY

Ladies' Cañon—F. Leveroni has applied to the California Débris Commission for a permit to mine this property by hydraulic process.

Red Star—In this mine at Alleghany, L. P. Woodbury, manager, a rich "blind" ledge has been encountered at a point 2300 ft. from the mouth of the tunnel which is being run to intersect the northern extension of the ledge of the Tightner mine.

Sixteen-to-One—This mine in Alleghany district has been bonded to Searls & McFall, of Nevada City. There is a 400-ft. tunnel on the property.

SISKIYOU COUNTY

Bread & Butter—At this mine near Fort Jones, Daniel McCarthy is taking out many large nuggets. The latest pocket found yielded \$8000 in all.

Cinnabar—A. M. Cowgill has located on the west fork of Beaver creek, near the Garretson Cinnabar springs, three claims of cinnabar ore.

U. S. & B. C. Mining Company—This company has finally accepted the bond on the Big Cliff group, owned by Wintering & Osgood, and will proceed at once to prepare for working the mine this winter.

TRINITY COUNTY

Nevley Thomas—In this mine on Packer's gulch, near the head of Copper creek, ore of exceptional richness has been discovered.

TUOLUMNE COUNTY

Excelsior—This mine, near Sugar Pine, worked profitably in early days, has been bonded to James E. Conde, of Arastroville, who will reopen it. The mine is on the East Belt.

Hazel Dell—The shaft at this mine is being unwatered and retimbered, so the property may be examined by intending purchasers.

Kern County Gold Mines Company, Ltd.—This company, F. W. Gwynne, superintendent, has taken the Jumper mine, at Stent, under a working bond for a year, and men have been set at work.

Nonpareil—This company is being reorganized and meantime the mine is being worked by leasers.

Rhode Island—Work has been resumed at this mine, which has been closed down several years.

Wild Cat—A shoot of rich ore in a 12-in. vein has been found while sinking the shaft in this mine. R. L. Hendricks is superintendent.

Colorado

BOULDER COUNTY

Montgomery-Goldfinch—Denver, Boulder and Eastern men are interested in this property at Jamestown, and they intend to erect a 50-ton cyanide plant for treatment of their own and custom ores, as well as to install a power plant on Jim creek, to supply power for mines and mill. L. W. Aldrich, Boulder, Colo., is in charge of operations.

Gilpin-Boulder Consolidated Mines Company—Denver and Boulder parties have purchased the Ragged Top group at Sugar Loaf and are installing a plant of machinery. E. H. Crabtree, of Boulder, is in charge.

Gold Run—Colorado Springs and Boulder owners of the Tambourine mine are building a 50-ton cyanide plant at Wall Street, to handle the low-grade ore. F. C. Tiffany, Colorado Springs, is manager of the property.

Union Mining and Development Company—Chicago men have purchased for \$20,000 the Hugo ranch near Nederland, and extensive operations are planned by E. J. Short and associates.

GILPIN COUNTY

Calumet & Colorado Mining Company—Michigan copper capitalists have become interested in the Success-Meeker property in Lake district and will install a plant of machinery and carry on active developments.

War Dance—The litigation in regard to this claim, where high-grade telluride ores were found last spring, has been settled, and the lessees will still carry on operations. C. O. Richards, Central City, is in charge.

Buckley—It is reported that this property has been sold to W. F. Morphy, of Denver, and Eastern associates, for the sum of \$50,000. A Leyner air-compressor plant has been ordered and the operators intend liberal developments. J. Loughran, Central City, is superintendent.

Gold Spring Group—Interests in this property in Pine creek district have been sold to Leander A. White, of Tolland, Colo., and operations are to be carried on through the Gold Spring tunnel.

Sampson—This group in Leslie gulch has been sold to the Copper Six Mining Company. It is the intention to install machinery and sink the main shaft. John Petersen, Tolland, Colo., is superintendent.

Union City Mining and Milling Company—Indiana men are interested, having purchased the Weidmann group of claims in Pine creek district, have installed a plant of machinery and will erect new buildings. O. G. Gist, Tolland, Colo., is superintendent.

A. K. R. Gold Mining and Milling Company—Articles of incorporation have been filed, showing capital stock of \$300,000, with G. M. Ashmore, of Rollinsville, Colo.; G. W. Kraft and F. H. Rehling, of Decatur, Ill., as incorporators. The company owns and operates the Smuggler mine and mill in Moon gulch, near Rollinsville. G. M. Ashmore, Rollinsville, is manager, and there is some talk of increasing the milling capacity.

Illinois Gold Mining and Milling Company—Denver men are interested in the Twelve Mile district, where they have opened up a good body of concentrating ores and are thinking of erecting their own mill. George L. Holland, Apex, Colo., is superintendent.

LAKE COUNTY—LEADVILLE

Big Evans Gulch—The mines in this section of the district are already beginning to feel the benefits of the driving of the Yak tunnel. A number of idle shafts that were filled with water are now nearly dry. This is accounted for by the fact that the tunnel has crossed the Ball mountain fault, thereby taking the bulk of the water from the different properties. This being the case, it is very probable that several shafts will resume work in the near future.

Yak Tunnel—The owners of the A. Y. & Minnie have leased the property for a number of years to the Yak company. Laterals will be run from the tunnel level to the A. Y. & Minnie ground, opening the orebody at greater depth than that now attained. When the ground is thoroughly opened a large force of men will be put to work breaking ore.

Valley Shaft—The Rio Grande railroad recently completed the switch to this property, South Evans, and now the mine is enabled to ship 40 tons daily of a good grade of ore.

Fryer Hill—The Forepaugh is being worked through the Sliver shaft and a regular tonnage of good iron is being sent to the smelter. The old dump of the Dunkin is being sorted and the lessees are shipping a fair tonnage of excellent ore daily. From the Robert E. Lee the lessees

are shipping steadily to the Salida smelter a good grade of iron. A drift is being run from the bottom of the shaft to catch the rich ore that made the mine famous in the early days of the camp; the drift is now in 150 ft. and has another 50 ft. to go to the objective point. Some good silicious ore is being shipped from Matchless No. 5 shaft. A new engine and hoist are being installed at No. 7 shaft, and underground work will be started this week.

Star of the West—The lead ore that was opened in this property, south side of Iron hill, a few weeks ago, has been developed and proves to be a fine ore-shoot and not a pocket. Thirty tons daily of high-grade lead ore is being sent to the Arkansas Valley smelter.

Crescentia—In August this property, Rock hill, shipped 200 tons of good grade of lead ore from the old workings. At present development work is being confined to driving into new territory to catch the ore-shoots that trend from southern Iron hill.

Little Jonny—During the latter part of the month all of the repairs at No. 4 shaft, Breece hill, were completed, and a number of lessees are again at work in this part of the property. In addition to the shaft being repaired, a new foundation was set under the engine.

SAN JUAN COUNTY

Gold King—Work is well advanced on the new tramway and the mine buildings, to replace those destroyed by fire. The mine is ready to resume work as soon as the tramway is finished.

Red Mountain District—This district is active. Regular shipments are being made from the Genesee. Work has begun on the Gold Lion and the National Belle. Good progress is being made in unwatering the old Yankee Girl mine.

Idaho

SHOSHONE COUNTY

Tiger-Poorman—The news that the Federal Mining and Smelting Company is about to abandon this property has come as a sort of thunderbolt to the miners of the Burke section. Work has already been started in the Standard mine at Mace, cutting a station for the great pumps of the Tiger, and these will be moved to the new property as soon as a place has been made for them. In the meantime all the men at work on the Tiger are engaged in cleaning up and as soon as this has been done and the machinery removed, the big mine will pass into history. The closing down of this mine on account of the giving out of the orebody is significant, and is the first mine in all the Cœur d'Alene district in which an action of this sort has been taken.

Blue Bell—Another strike of galena is reported from this property, located on Big creek. Sometime ago after driving

a 300-ft. adit the vein was intersected and good ore carrying lead and silver was encountered.

Pilot Mine—Another rich pocket of ore is reported to have been found. An attempt is now being made to strike the shoot at depth, and the indications in the lower tunnel are said to be good.

Clearwater Gold Mining Company—This company is expending about \$7000 in the installation of hydraulic power. The claims of the company are located in St. Joe county, and for some time past the gravel being worked has panned from a minimum of 25c. a yard upward. The company owns about two miles of the creek bed.

Iron Mask—Six feet of good milling ore has been opened up in this property, located in the Carter mining district. This strike is of importance to a large number of prospects working in the district. The ore is lead-silver and was encountered at a distance of about 900 ft. from the portal of the tunnel and at a depth of about 500 ft.

Surprise—The mine and mill on Pine creek has resumed with a full force of men and shipments have been made. Last year a mill of 125 tons daily capacity was erected and after running a short time was closed down on account of the depreciation of the metal market.

Mineral Point—A strike of about 3 ft. of gray copper ore has been made in the upper workings.

Liston Mining Company—About \$12,000 is to be expended in new equipment. Ten men are engaged drifting on the vein, which has been proved in length to the extent of 4800 ft., and in width to 60 ft.

Indiana

BLACKFORD COUNTY

There has been a marked falling off in the product of oil wells in the Montpelier district, due to the decreased demand. Recent development, however, brought in 12 wells with good average production.

GREENE COUNTY

Vandalia Coal Company—This company has adopted a plan to relieve suffering miners and lessen the injuries resulting from mine accidents. A series of lectures are being given to mine bosses on "First Aid to the Injured." They are told what to do before and after removing an injured man from the mines. At each of the Vandalia mines, hereafter, will be found a room which contains medicine and bandages, and the mine boss is being taught to care for the men until physicians arrive.

VIGO COUNTY

Du Pont Powder Company—Three more suits have been filed for damages against the company growing out of the Fontanet explosion last October. There

are now about 100 suits pending, mostly for damages to miners or members of miners' families.

Michigan

COPPER

Forest Fires—Serious forest fires broke out on Sept. 8 near the Ahmeek mine, which, at the time of the latest press despatches, threatened not only the town of Ahmeek, but also Calumet and the entire copper district. Firemen from Calumet, Tamarack, Mohawk, North and South Kearsarge and Wolverine, assisted by 1000 miners, were on the ground fighting the flames. A number of villages on the Mesabi range, Minnesota, including Hibbing, were also threatened with destruction by fire which was sweeping the country.

King Phillips—This company has added several additional drilling machines to its underground installation, and consequently a larger tonnage is to be taken out. A most encouraging showing is being made at the various levels. The shaft is put down in the footwall and crosscuts driven through the lode.

Keveenauc—All operations at the Medora shaft are being concentrated in opening up stoping ground and otherwise making ready to maintain regular shipment to the mill direct from underground as soon as the snow comes and interferes with the shipment of rock from the stock pile. At present about one-half the rock is coming from the stock pile. At the Phoenix mill the old jigs have been replaced by the Woodbury type.

Superior—The spur connecting the Superior shaft with the Atlantic railroad has been completed. The two heads of the Atlantic mill which are to treat this rock have been overhauled and put in working order. Shipments will be made from the stock pile, which has accumulated during the past four years of development work, but as soon as the shaft house is erected rock will go direct from the underground openings. The crosscut from the 10th level has reached the lode.

Isle Royal—The structural steel for the new shaft house on the site of No. 6 shaft has been raised and the building is now ready to receive the sheathing. The underground conditions at Nos. 4, 5 and 6 shafts, the newest of the company's openings, are most encouraging, and the copper content of the rock is showing better than at the northern portions of the tract.

Victoria—Explorations are being carried on in three different manners, crosscutting, tunneling and diamond drilling, all in view of opening a better grade and a more consistent copper-bearing formation. A crosscut is being extended from the 19th level of the shaft toward the south, and from the river bank a tunnel is being driven toward the shaft; in this manner the southern portion of the tract will be

exposed while to the north a diamond drill is in operation.

Winona—The electrically-operated hoisting plant is ready and will be tried out preparatory to going into regular service.

Calumet & Hecla—This company has completed the erection of a high-tension pole line connecting its substation at Calumet with Lake Superior water works, and at that point a 3,000,000-gal. centrifugal pump is being installed. At No. 15 shaft on the Osceola amygdaloid lode preparations are about completed to begin hoisting from the second compartment. An engine for each compartment is to be used temporarily.

North Lake—Preparations are about completed to begin diamond drilling on the lands of the newly organized North Lake property. Two drills will be put into service and two parallel cross-sections of the tract made; in this manner the various formations will be exposed, also their trend and continuity.

Tamarack—No. 2 shaft house is being remodeled to accommodate the use of Kimberly skips in place of the cage and cars now in use.

Montana

BUTTE DISTRICT

Tuolumne—Grading is being done for the new boiler and air-compressor plant. The management states that a 1000 h.p. boiler plant has been ordered and also a 20-drill cross-compound two-stage air compressor. At the 800-ft. level a station 18x45 ft. has been completed, and a crosscut is being driven to the lead. Ore is being extracted from the 1000-ft. level. Storage ore-bins with a capacity of 258 tons have recently been erected.

Davis-Daly—Sinking* on the Colorado shaft continues. The shaft is now down past the 1200-ft. mark.

Copper Eagle Mining Company—Sinking on the shaft is in progress. A short distance below the 250-ft. mark in the shaft an ore-shoot was encountered. The shoot pitches to the west in the vein and runs high in silver.

Pittsburg & Montana—The Pittsmtont mine is producing on an average of 200 tons daily. The management states that the new 300-ton concentrator will be entirely completed in two weeks. The water pumped from the mine will be used in the concentrator.

North Butte—The ore pockets and stations at the 2000- and 2200-ft. levels have been completed, and from both stations crosscuts are being run to the veins. When ore is ready to be hoisted from these levels more power will be required for the hoisting engine. With this end in view two new boilers, giving an additional 500 h.p., are being installed. The mine is producing between 1300 and 1500 tons daily.

Red Metal—At the tramway shaft sinking is in progress below the 1500-ft. mark. From the 1500 station a crosscut is being driven north to develop the adjoining Minnie Healy ground. Crosscuts are also being run north from the 1300 and 1400 stations for the same purposes. Owing to the smouldering fires in the old stopes on the upper levels of the Minnie Healy, the mine has not been worked through its own shaft for over a year. At the Rarus mine preparations are being made for sinking the shaft below the 2000-ft. level, and it is expected that the work will soon begin. The Red Metal mines now produce on an average of 1000 tons daily, and this will be gradually increased as the orebodies of the Minnie Healy are opened up.

BEAVERHEAD COUNTY

Benton Mining and Milling Company—The properties are located in what is known as the Quartz Hill mining district, and carry principally silver, with some gold and copper. The claims have been idle for the last 15 years until the organization of this company last spring. The shaft on the Argyle claim is down 150 ft. Butte men are in control of the company.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Production—The output for the week past amounted to 2388 tons, valued at \$178,520. The Combination mill treated 560 tons of Consolidated ores. The Western Ore Purchasing Company handled from: Mohawk Jumbo, 610 tons; Van Riper lease, 31; Engineers lease, 43; Mushett, 54; Consolidated Red Top, 58 tons. The Nevada Goldfield Reduction Works treated from: Engineers lease, 208 tons; Little Florence, 29; Combination Fraction, 34; Francis Mohawk, 175; Curtis Mohawk, 100; Florence Annex, 36; Higginson, 40; Black Butte, 77; Begole, 265; Sandstorm, 18; Mushett, 50 tons.

Zinn Florence—Work is progressing rapidly on the 185-ft. level. In drifting along the hanging wall of the Jumbo dike toward the Baby Florence, scattered bunches of ore assaying from \$5 to \$80 have been found, indicating that the drift is approaching the orebody. The sub-lease on the 76-ft. level is looking good although the ore is bunched and irregular.

Portland—This mine is not working at present. One watchman in an eight-hour shift is able to hoist all the water which accumulates. This amounts to about 5000 gal. The shaft is 459 ft. deep. It is reported that the recent diamond-drilling failed to find any orebodies.

Florence Jumbo—The Von Polenz lease, otherwise known as the Florence Jumbo, is sinking its shaft with three shifts of miners. The shaft is now 310 ft. deep. Ore-bins are being erected. Stopping will begin when the 350-ft. level is reached.

Kansas City Goldfield Mining Company

—The Velvet lease of this company is making an excellent showing. A raise has been started from the 100-ft. level to connect with the winze from the 50-ft. level, in which ore assaying \$50 to \$60 per ton has been found. Work is being pushed on the 300- and also on the 500-ft. levels.

Goldfield Apex Mining and Leasing Company—This company has just started work at its lease on the Golconda. The shaft is 150 ft. deep. No drifting will be done until the 300-ft. level is reached.

Mohawk Ledge—The 300- and 400-ft. levels have been cleaned out, and the work of sinking another 125 ft. in the shaft has been started. The shaft will then be more than 600 ft. deep. It is expected to cut the rich Kalfus ore-shoot on its dip before that depth is reached.

Combination No. 3—The Mitchell-Fairfield lease is sinking at the rate of 5 ft. per day. The bottom of the shaft is now down 485 ft. A station will be cut for the 500-ft. level.

Begole Syndicate—This syndicate has just sold the Nevada Goldfield Reduction Works all its dump on Consolidated ground. This dump contains approximately 4000 tons of ore.

Red Hills Mining and Leasing Company—At the company's lease on the September claim, good assays are being obtained from streaks of ore cut in development work. The shaft, now 410 ft. deep, will be sunk to a depth of 500 feet.

Empire—The Goodfriend lease on the Empire has a small vein, between one and two feet wide of ore assaying \$40 per ton. This is in the vicinity of the Commonwealth claim from which leasers are shipping.

ESMERALDA COUNTY—RAWHIDE

Royal Tiger—At the Stinson lease on the Royal claim of the Royal Tiger the incline shaft down to the 220-ft. level is all in ore. The company intends to sink a vertical shaft to tap this orebody. On the 30-ft. level for a distance of 30 ft. the ore has been stoped to surface, and shipments show an average value of \$250 per ton. The company is mining 3 tons a day of this grade of ore.

Veteran Miller Lease—The first ores treated in the Watt mill, that has just been completed, came from this lease. From the 40-ton initial shipment an 84-oz. bar of bullion was obtained, worth \$16 per ounce.

Codd Mill—This 10-stamp mill, being erected at Rawhide Junction, the western terminus of the Rawhide Western railroad, is expected to be running by the end of October. It will treat ores from the Rawhide Mining Company's mines and from the St. Ives lease on the Rawhide Queen property.

Sweet Mill—It has been announced that a mill by this name will be built on Re-

duction Flat, south of the townsite. The capacity will be 40 tons.

ESMERALDA COUNTY—GOLD MOUNTAIN

Nevada Empress Company—With the exception of the engine all the machinery has been installed in the Hathaway mill of this company. The tunnel is supplying almost enough water for the plant, the balance will be obtained from wells.

NYE COUNTY—TONOPAH

Production—Tonopah is producing at the rate of \$9,278,100 per annum. This week's production amounted to 6675 tons of ore worth \$178,425. The Tonopah Mining produced 3700 tons; Belmont, 1000; Montana Tonopah, 1050; Midway, 100 tons; MacNamara, 350; West End, 105; Jim Butler, 200; North Star, 40; Tonopah Extension, 130 tons.

Belmont—In the face of the east drift on the A vein, 50 ft. north of the Mizpah fault, the vein is 2½ ft. wide, all good ore. This vein, when first cut by the main east crosscut was but 10 in. wide. The face of the west drift along the hanging wall of the Mizpah fault shows that the vein is increasing in width, it being over a foot wider than last week. The whole winze being sunk on the orebody, exposed by the east drift from No. 24 south crosscut is in ore. The dip of the winze is gradually being changed so that the winze will be nearer the hanging wall. At the bottom of the winze, this vein is known to be over 20 ft. wide, and the hanging wall has not yet been reached. The ore is becoming richer as the hanging wall is approached.

Tonopah Extension—Mr. Krumb has completed his examination of the mine.

Tonopah Mining Company—Most of the ore at present comes from the Mizpah vein on the 500- and 600-ft. levels and from the Valley View vein on the four levels between the 240- and 540-ft. levels. The Mizpah vein averages 10 ft. in width and the Valley View 5 feet.

MacNamara—The pipe line from the power house of the Tonopah Extension has been completed and four additional drills have been started in the MacNamara mine, making eight air drills now in operation. Half of these are drilling in ore and the other half are on development work. On the 300-ft. level the vein contains 4 ft. of high-grade milling ore in the easterly stope and 3 ft. of good milling ore in the westerly stope. The new orebody on the 250-ft. level 50 ft. south of No. 1 stope continues to have a width of 4 to 5 feet.

Montana-Tonopah—The east drift on the south vein on the first or 390-ft. level was advanced 20 ft. during the week. This vein contains 2 ft. of good milling ore. On the second or 465-ft. level in the Macdonald stopes, 800 ft. west of the shaft, the vein contains 3 ft. of good ore. These stopes are 150 ft. long with ore the

entire distance. In the new stopes started above the drift the orebody has widened to 12 ft. and is of milling grade.

Jim Butler—Extensive development is going on in this property. With the exception of the south crosscuts on the 200- and 400-ft. levels from the Stone Cabin shaft all breasts are in ore. On the 100-ft. level the west orebody has widened considerably. The shaft now 615 ft. deep will be sunk to a depth of 800 ft. Crosscuts will then be run.

NYE COUNTY—CACTUS RANGE

Cactus Range Gold Mining Company—This company has been developing its property for about two years. During the financial trouble and owing to a heavy flow of water the property was idle, but now a compressor and a pump having been installed, the work of sinking the shaft has been resumed.

NYE COUNTY—ROUND MOUNTAIN

Solid Gold Mine—Only two wagon-loads of material are required to complete the mill. The company has purchased machine drills, which will be started at once; these are the first machine drills in the camp. The company has obtained preliminary bids on a cyanide plant.

Sphinx Mill—The management is considering increasing the capacity of the mill. At present the mill is treating 25 tons per day and is cleaning up \$11,000 per month, but the mine can produce more ore.

Round Mountain Reduction Company—The mill is making a test run of ore from the Nazro lease; this ore is expected to average more than \$30 per ton. A test run will also be made on ore from the Gallagher-Gordon lease on the Daisy.

NYE COUNTY—MANHATTAN

Manhattan Milling Company—This company, which now has the Lemon mill, has completed improvements, and has started up the mill. The initial run is being made on \$150 ore from the Shea lease on the Union No. 9 claim. The company guarantees to save 90 per cent. of the assay value.

WHITE PINE COUNTY—ELY

Nevada Consolidated Copper Company—Contracts are to be let immediately for the fourth unit of the concentrator. The work of excavating for the foundations begins this week. There are 1050 men on the pay-roll at present, but this new work will largely increase the force. The first section of the second unit is completed, and the other section will be finished in another week. The third unit will be completed in four to six weeks. The smelter is producing about 30,000 lb. of blister copper per day, or at a rate of 10,800,000 lb. per year. The reverberatory capacity is large enough to treat the concentrates when the mill is handling 7000 tons of ore per day.

New York

ESSEX COUNTY

It is reported that the iron mines at Sanford lake are to be reopened. These mines were operated for about 30 years, supplying local forges and furnaces, but work was suspended over 50 years ago on account of the cost of transportation. It is now proposed to connect the mines with Lake Champlain by a railroad about 55 miles long, to be operated electrically. The ore deposit is large, and much of it carries 50 per cent. iron.

North Carolina

ASHE COUNTY

Copper Knob—This old mine that gained notoriety on the New York mining boards in 1880 to 1882, is again in operation. The vein carries bornite and other copper ores with gold and silver.

ORANGE COUNTY

North State Mining Company—This company, composed of Pennsylvania capitalists, is opening up a mine near Teer P. O. The vein is quartz and carries gold. The company is erecting a 10-stamp mill and will have it in operation within 60 days. H. L. Whiteman, is superintendent.

Pennsylvania

BITUMINOUS COAL

Haws Coal Company—This company in Somerset county, has completed the sinking of its shaft to the B seam and is now making rapid progress in the development of the inside workings. The construction of the headframe and tippie was completed, about a month ago. A pair of Lepley self-dumping cages were installed, together with a Touhill first-motion engine. The fan was put in operation about a month ago and the company expects to be in shape to produce 800 tons per day for the winter trade. W. D. McCausland, is general superintendent and C. P. Collins, chief engineer.

Jenner-Quemahoning Coal Company—This company, in Somerset county, which began sinking No. 2 shaft on the E seam to the C, on June 17, a distance of 95 ft., completed the sinking on Aug. 17. The company expects to instal a rope haulage for the working of the dip headings and in six months the output for this shaft will be in the neighborhood of 2000 tons per day. At this rate the output for the two shafts will be about 4000 tons. John Gibson, Jr., is superintendent and C. P. Collins, resident engineer.

Quemahoning Coal Company—This company, at Ralpton, has completed the construction of one mile of railroad to No. 4 mine. The tippie was completed about a month ago and the mine, which was opened last October, has been driven a distance of 1200 ft. The company is at present installing a motor haulage

which will be completed within 10 days; this will increase the output to 600 tons per day. In six months it is expected to ship 1500 tons per day from this mine. Mr. Summerville is general superintendent and C. P. Collins, chief engineer.

South Dakota

LAWRENCE COUNTY

Alder Creek—Plans for the consolidation of the Alder creek, Wasp and other properties are about completed. It is expected to erect a 500-ton treatment plant to handle the large orebodies.

Homestake—Two additional filter presses are being put in and four more will be added shortly, in order to handle the increased amount of slimes caused by the operation of the regrinding plant. This should increase the capacity of the slime plant to 1800 tons daily.

Imperial—A vertical lode 3 ft. wide has been struck on the Dakota claim in the quartzite formation at a depth of 575 ft. The vertical was found in the east drift 80 ft. from the shaft and is believed to be the main orebody.

Tinton—A carload of tin concentrates has been sent to London for the benefit of an English company interested in an option. The mill is handling 800 lb. of tin concentrates per day.

CUSTER COUNTY

Extreme—This claim was sold at receiver's sale to R. T. Walker, of Keystone, who will organize a company to operate the 10-stamp mill and the ground.

Westinghouse—The company is shipping to Pittsburg 150,000 lb. of mica weekly from its Custer properties and is working 112 employees. The vein, 40 ft. wide on the 200-ft. level, is supplying the plants with mica.

Utah

JUAB COUNTY

Tintic Shipments—In August, the mines of the Tintic district produced about 23,000 tons of ore, the mines contributing and the number of carloads dispatched being: Beck Tunnel, 14; Black Jack, 1; Bullion Beck, 9; Bullock, 1; Carisa, 11; Centennial Eureka, 167; Colorado, 101; Eureka Hill, 18; Eagle & Blue Bell, 5; Dragon Iron, 23; Grand Central, 34; Gemini, 3; Iron Blossom, 11; Lower Mammoth, 13; Homestake, 3; May Day, 20; Swansea, 9; Swansea (lease), 4; Sunbeam, 1; Uncle Sam, 20; Victoria, 2; Yankee Consolidated, 7 cars.

Lower Mammoth—In a raise from the 1600 level, a body of rich gold ore was encountered last week. It is regarded as being one of the most important finds ever made in this property.

PIUTE COUNTY

Gold Development—This company, which has been developing a gold prop-

erty near Marysvale, has announced through its president, H. J. Maynard, of Philadelphia, that preparations have been made to broaden the campaign of development and that facilities will be provided to treat the large bodies of low-grade ores. Power equipment is also to be installed.

Wisconsin

ZINC-LEAD DISTRICT

Benton—This camp is at present the biggest shipping point in the district; the Frontier, Etna, Vandeventer, Pittsburg-Benton, Corr and Fox are the heaviest producers. Two new roasting plants will be built by the Fox and the Benton Mining and Development companies, the latter representing a consolidation of a number of local companies. The Calvert is preparing to erect a 100-ton mill.

Cuba City—Northern Michigan men are endeavoring to effect a consolidation of the Baxter, Big Four and Roosevelt properties. Another consolidation mentioned includes the Dall, Gritty Six, Meekers Grove and Anthony. The Dall and Baxter, which have been holding their zinc ore for better prices, are shipping again. The Board of Trade and Pittsburg mills are completed.

Platteville—The Empire, Acme, Homestead and St. Rose are shipping again from this point. The Enterprise, Empire and Acme roasters are running full blast. The electrostatic separator closed down Aug. 29 to make necessary repairs; this plant is now equipped to handle 75 tons of concentrates every 24 hours. The Cruson has foundations laid for a 50-ton mill. The Lyght is drilling to locate its ore range south of the shaft, where an incline shaft will be sunk and a concentrator erected.

Canada

NOVA SCOTIA

Dominion Coal Company—The output for August was estimated at 310,000 tons. For the eight months ended Aug. 31 the total output was 2,602,619 tons, as compared with 2,291,022 for the corresponding period of 1907. The branch line to No. 12 mine has been completed and accumulations of coal are now being shipped. Work on No. 14, situated a mile farther west, has been started. Vice-president Wanklyn reports a steady market and anticipates that the year's output will reach about 4,000,000 tons.

Boston-Richardson—This mine, at Goldboro, has gone into liquidation, the Supreme Court having appointed the Eastern Trust Company receiver. The company has \$59,000 first-mortgage bonds, \$350,000 consolidated bonds and about \$52,000 floating debt. The present company—of which Franklin Playter, of Boston, is president—took the old Richardson mine in 1903, and has spent a large sum in

improvements, new machinery, etc. The mine is a large low-grade deposit, and it is said that the working costs have been less than \$2 per ton; but for some months the expenses have exceeded the receipts.

ONTARIO

Canadian Oil Fields, Ltd.—An order has been obtained at Toronto winding up this company, John D. Noble being appointed interim liquidator. The company was organized in England to buy up Canadian oil properties, nearly all its property being mortgaged to secure indebtedness. George A. Sedgwick, the applicant, holds mortgages for \$10,000 advanced.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt, for the week ended Aug. 29 were as follows: Buffalo, 91,000 lb.; Kerr Lake, 61,000; La Rose, 414,000; McKinley-Darragh, 61,000; Nova Scotia, 40,000; O'Brien, 191,000; Townsite, 40,000; Hudson Bay, 120,000; total, 1,018,000 pounds.

Princess—A new vein has been discovered in driving on the main vein at 70 ft., which carries about 4000 oz. silver to the ton.

Temiskaming—In sinking a new shaft away from the orebodies, to be used as the main shaft, a rich blind vein has been struck at 75 ft. of calcite, niccolite, and native silver. It is reported to be of unusual width.

Trethewey—A financial statement, as of Sept. 1, issued by the company, shows cash in bank, \$123,543.96, due from smelters, \$41,795; value of ore sacked and in transit, \$23,113; a total of \$188,451.69. The dividend amounts to \$47,273, leaving a balance of \$141,179 on hand.

ONTARIO—MANITOU LAKE

Detola Gold Mine—This mine has been equipped with a new compressor plant and boiler, supplied by the Canadian Rand Company. Active mining operations have been resumed.

Mexico

JALISCO

Amparo—During the month of July the extraction secured at the reduction plant in the Etzatlan district was 93.5 per cent. During the month of June the extraction was 82.96. In July the ore crushed amounted to 3,180 tons, and in June to 3,205 tons. William Howard, formerly at the Esperanza mine in the El Oro district, is now in charge of the Amparo reduction plants. The ore hoisted from the Amparo mines in July amounted to 3,605 tons. For every ton of ore hoisted another ton was broken and left in the stopes as a reserve supply. In addition, at the upper terminal of the aerial tramway connecting the mines and the 40-stamp mill, there is an ore reserve of 6,000 tons.

Bolaños—Because of delay in turning over the mines to the Bolaños Mining Company of St. Louis, the result of legal technicalities, the supreme court of Mexico has issued a peremptory order for the immediate transfer of the mines to the American company. The order is directed to Judge Vicencio of the federal district court of Jalisco.

SONORA

Harris Copper Company—Another transfer of the La Caridad property has been reported at a price approximating \$40,000. This property lies about three miles to the east of the Pilares mines of the Moctezuma Copper Company, and has about 6000 tons of ore developed averaging from 4 to 6 per cent. copper. The vendors are represented by Frank M. Watts, of Nacozari and the purchasers by the firm of Whelan & Werner, of Los Angeles. The property will be added to the other holdings of the company.

Moctezuma Copper Company—The second unit of the new 2000-ton concentrator now being erected at Nacozari is nearing completion, and the full plant will be in operation about Sept. 15. H. K. Burch, who has been acting as superintendent temporarily will, on the completion of the plant, leave for Globe, Ariz., to take charge of the erection of the new plant projected for the Miami Copper Company, of that place.

Silver Scal Exploration Company—This company, incorporated under the laws of Arizona for 150,000 shares of the par value of \$10 per share by John A. Judah and associates, of Los Angeles, has commenced work on the "Capillo" mine a few miles south of the Pilares. The company was incorporated in July of this year, and in addition to the above property, owns the "La Juela" claim, near the Sonora river, west of Cumpas.

Carterra Mining Company—This company has given an option on the majority of the stock to J. T. Boothroyd and associates, of Douglas, Ariz., and it is expected that development work will be commenced in the near future.

Belen Mining Company—The properties of the company lying west of Cumpas are being examined by an engineer acting for the controlling interests and future operations will depend upon his report.

El Tigre—Conflicting rumors are afloat regarding the proposed, or supposed, sale of the "El Tigre" mine west of Yzabel. It is generally accredited to people in close touch with the Phelps-Dodge interests, but the sale is said to be to the Standard Oil Company and associates, of New York City. No examination has been made as yet. The price reported is \$100 per share on the capitalization of 65,000 shares. The stock sold at \$6 per share during the lawsuit of a year ago, on a par of \$10, and now commands about \$40.

Metal, Mineral, Coal and Stock Markets

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

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Sept. 9—The coal trade in the West is again reported as showing a slight improvement. The gain is gradual, but can still be noted as a gain. The demand for steam coal is the chief point, and that is said to show now a total equal to about 60 per cent. of the high level of the early part of last year. Of course, there are local variations, but the figure given represents the general average.

The Lake trade is less held up by congestion at the docks at the upper ports. There is still a good deal of coal to go forward on contracts, but it can probably be sent without any great rush at the end of the season.

The Alabama strikers are ready to go to work again. The operators, while their position has been sustained, say that they will not refuse work to the men as individuals, but will employ all the labor that they need, without recognizing the union.

In the East the bituminous trade shows little change. The anthracite trade is also quiet, notwithstanding the season. The Coastwise trade shows a slight improvement.

COAL TRAFFIC NOTES

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Aug. 29, in short tons:

| | 1907. | 1908. | Changes. |
|-------------------|-------------------|-------------------|---------------------|
| Anthracite..... | 3,758,153 | 3,353,696 | D. 404,457 |
| Bituminous..... | 25,599,696 | 21,431,663 | D. 4,168,033 |
| Coke..... | 9,326,687 | 4,471,614 | D. 4,855,073 |
| Total..... | 38,684,536 | 29,256,973 | D. 9,427,563 |

Total decrease this year to date was 24.4 per cent.

Anthracite coal shipments in August were 4,599,094 long tons, being 57,588 tons more than in July, but 997,923 tons less than in August, 1907. For eight months ended Aug. 31 the shipments were, in long tons:

| | 1907. | 1908. | Changes. |
|---------------------|-------------------|-------------------|---------------------|
| Reading..... | 9,106,769 | 7,787,233 | D. 1,319,536 |
| Lehigh Valley.... | 7,612,807 | 7,143,440 | D. 469,367 |
| N. J. Central..... | 5,785,407 | 5,475,650 | D. 309,757 |
| Lackawanna..... | 6,904,349 | 6,601,398 | D. 302,951 |
| Del. & Hudson.... | 4,344,552 | 4,188,863 | D. 155,689 |
| Pennsylvania.... | 3,851,991 | 3,835,603 | D. 16,388 |
| Erie..... | 4,782,998 | 4,887,862 | I. 104,864 |
| N. Y., Ont. & West. | 1,814,409 | 1,890,973 | I. 76,564 |
| Total..... | 44,203,282 | 41,809,042 | D. 2,394,240 |

Only two companies—the Erie and the New York, Ontario & Western—show gains this year. The total decrease was 5.4 per cent.

New York

ANTHRACITE

Sept. 9—Anthracite trade continues dull for the prepared sizes. Apparently no one thinks of putting in stocks yet. In steam sizes there is some demand for pea and buckwheat, which are in rather short supply.

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

BITUMINOUS

There is no change in the Seaboard bituminous trade, activity showing here and there, and then ceasing for a time. Little business is coming from the Far East, though the time is rapidly approaching when winter stocks must be put in at the ice-making ports. Inquiries are coming from the Sound ports to some extent.

New York harbor trade is moderate. Ordinary grades of soft coal are selling at \$2.40@2.45; better grades at \$2.55@2.60. All-rail trade is quiet. Cars are in good supply, but transportation has been a little slow, owing to the rush of passenger traffic around Labor Day.

Coastwise trade is about the same, and rates are hardening, though there has been no actual change. Rates for large vessels from Philadelphia are: Boston, Salem and Portland, 50@55c.; Lynn, 60@65c.; Newburyport, Gardner and Bangor, 70@75c.; Portsmouth, 55@60c.; Bath, 65@75c.; Providence, New Bedford and the Sound, 50c. From New York harbor ports 50c. is asked to Boston and Portland.

Birmingham

Sept. 7—Alabama will by the end of this week be producing its normal amount of coal and a little more, it is expected. The general resumption of operations at the mines is now on. The strike was declared off by the national officers of the United Mine Workers of America and this was indorsed by the district organization officers. The operators have announced that there will be no feeling shown in the re-employment of the old men and that as many as are needed will be given work in the mines. It is estimated that out of 18,000 strikers something like 15,000 men will get work again.

The United Mine Workers, it is understood, will care for the other men either in Alabama or in other States. The statement is also made that at each mine a check-weighman is to be placed, the miners employed to select such an official.

Several batteries of coke ovens will be started up by the end of the week.

Chicago

Sept. 8—The coming of September has made a slight improvement in the steam coal market, but trade is still far below the hopes of dealers. In the domestic market bituminous coals are slowly increasing in sale; anthracite, with the arrival of the end of the discounts, is dull and is expected to remain dull until the coming of cold weather. Eastern coals are bettering their sales more rapidly than Western.

Lump from Illinois and Indiana mines shows improvement in country districts and fine coals are less in demand relatively. Lump brings \$1.75@2.45, run-of-mine \$1.55@1.75 and screenings are almost dull at \$1.35@1.55, for car lots.

Eastern coals hold well to circular prices which in some cases have been advanced slightly as a result of the increased demand, the increases resulting in practically no change in the volume of sales. Smokeless is in increasing demand from country as well as city trade, and Hocking sales are good. Gas coals move steadily on contracts at standard prices, with a small outside market.

Indianapolis

Sept. 7—President Lewis, of the United Mine Workers and President Van Horn, of District No. 11, are engaging in a bitter contest over their respective authority. President Lewis has ordered the Rood miners to work at once, but Van Horn insists that no man return to work until a discharged driver is reinstated. Lewis says he will throw the district organization out of the National Association, and the situation is interesting.

Pittsburg

Sept. 8—Mine operations in the district increased this week, and 80 per cent. of the railroad mines are running. The congestion at the Lake docks has been removed, and coal is being rushed for the Northwestern markets. The river mines are practically suspended, as all the empty

coal boats and barges are loaded. Large operators are holding prices on the basis of \$1.15 a ton for mine-run coal at mine. Sales by smaller producers are reported as low as \$1. Slack continues to be a drug on the market, and sales are recorded at around 30c. a ton.

Connellsville Coke—Improvement in the coke trade is noted, and prices are firmer. Furnace coke on contract is quoted at \$1.65@1.85, and foundry at \$2.10@2.25. Several important contracts were closed during the week. The *Courier* in its weekly summary gives the production in both fields at 200,283 tons. Shipments were 7777 cars as follows: To Pittsburg, 3169; points west of Pittsburg, 4173; to points east of Connellsville, 435 cars.

Foreign Coal Trade

United States Coal Exports—Exports of coal and coke from the United States, seven months ended July 31, long tons:

| | 1907. | 1908. | Changes. |
|-----------------|-----------|-----------|------------|
| Anthracite..... | 1,489,511 | 1,587,299 | I. 97,788 |
| Bituminous..... | 5,644,219 | 4,897,677 | D. 746,542 |
| Total coal..... | 7,133,730 | 6,484,976 | D. 648,754 |
| Coke..... | 512,036 | 368,392 | D. 143,644 |

These figures do not include coal furnished to steamships in foreign trade. Canada took this year 4,947,748 tons of coal, or 76.3 per cent. of the total. The coke went chiefly to Mexico and Canada.

United States Coal Imports—Imports of coal and coke into the United States, seven months ended July 31, long tons:

| | 1907. | 1908. | Changes. |
|-----------------|-----------|---------|------------|
| Anthracite..... | 12 | 15,023 | I. 15,011 |
| Bituminous..... | 1,128,456 | 912,820 | D. 215,636 |
| Total coal..... | 1,128,468 | 927,843 | D. 200,625 |
| Coke..... | 79,935 | 73,307 | D. 6,628 |

Canada furnished this year 615,267 tons of coal and nearly all the coke; Australia, 260,588 tons coal. Imports are chiefly on the Pacific Coast.

Welsh Coal Market—Messrs. Hull, Blyth & Co., London and Cardiff, report prices of Welsh coal as follows, on Aug. 29: Best Welsh steam, \$3.96; seconds, \$3.78; thirds, \$3.48; dry coals, \$3.72; best Monmouthshire, \$3.54; seconds, \$3.30; best small steam, \$2.28; seconds, \$1.98. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Sept. 9—There has been little of special note in the iron and steel markets during the week. The advance promised in September has not yet made its appearance, and may be postponed for a time.

Pig iron has been fairly active, especially in the foundry grades. Buyers, however, are cautious, and will not listen to any advance in prices. Makers are, therefore, not realizing any better prices; but they are not as ready to make concessions as they were. There is some improvement in basic pig, but prices are making difficulty.

In finished material there is a fair demand for bars, and sheets are a little more active. Structural material shows little improvement, and large contracts are still being held back. Inquiries on small orders are more frequent, however. The railroads are still holding back.

Little is heard about export business, and the published figures show a considerable decrease in values from last year.

Birmingham

Sept. 7—With the coal-miners' strike a thing of the past and the general conditions throughout the country picking up, the Alabama pig-iron manufacturers are looking happier. No. 2 foundry is quoted at \$13 per ton. Business is coming in from all directions. The make in his section is holding up well. The settlement of the troubles in the coal mines was of great moment to the iron trade; both coal and coke were being brought from other States in order that there should be no hesitation in the iron production in this State. There is very little iron on the yards, and home consumption shows no falling off.

The steel plant at Ensley in month of August produced 32,424 tons of steel rail, the best month's production in the history of the plant. There is to be no cessation of operations at the steel plant, and in consequence it will be necessary to increase the output of the basic iron.

Baltimore

Sept. 8—Exports for the week included 1,136,608 lb. tin scrap to Rotterdam; 263,723 lb. wire and 1102 tons steel billets to Liverpool; 5062 tons of steel rails to Guaymas, Mexico.

Chicago

Sept. 8—The iron market is stronger as regards sales of finished materials, notably railroad supplies; pig iron, though not booming, shows no notable falling off. In fact, it is probably somewhat stronger than a week ago, the tendency being to increase purchases for the last quarter. Reluctance still exists on the part of sellers to contract freely for 1909 delivery at prices which melters will pay. For general business 500 tons is a good lot; occasionally a lot runs over this and into the thousand class. Small lots still comprise the bulk of the business. The abundance of inquiries for the first half of 1909 is held to be encouraging.

Efforts to hold Southern No. 2 iron firmly to \$13 Birmingham (\$17.35 Chicago) have not been successful generally and \$12.50 more nearly represents the prevailing price. Sales under conditions most favorable to the consumer as regards delivery and in small lots have been made at \$13. Northern iron is shaded slightly under the \$17 standard quotation for No. 2—perhaps 50c. on the most favored lots, 25c. on others. Northern charcoal iron holds at \$19.50, with light sales.

Coke continues firm at \$4.90 for the best Connellsville, with sales fair.

Philadelphia

Sept. 9—A general hardening of pig-iron quotations has set in, accompanied with a withdrawal of extremely low quotations in two or three instances and an increase in inquiries. Two causes led to this change, the realization among consumers that the pig-iron accumulations were reaching the vanishing point and that no interference of Southern irons is probable. Large orders are on the point of being closed today for both forge and foundry. The interest in forge is due to the information that large orders for common iron are about being placed. Buyers of basic are about closing for round lots. Makers have made a sudden about-face. A revision of 1909 delivery quotation may be announced any time. No. 2 foundry is selling in small lots better than for months. More pipe-iron inquiries have appeared and orders will be placed. No serious advance will be attempted, however, while there is so much idle capacity. No. 2 X is \$16; forge, \$15.50@16.

Steel Billets—A stronger tone is manifested and mills are again booking moderate orders. Shadings have been withdrawn.

Bars—Retail distribution throughout this territory has improved. Prices are unchanged. Large orders for car-building purposes are said to be in sight.

Old Material—The scrap dealers are selling very little and are not buying. Railroad scrap is now fully well cleaned up. Heavy steel is offered, but there are no takers at the price.

Pittsburg

Sept. 8—Improvement in mill operations is noted here and there in the Pittsburg district. This week La Belle plant of the Crucible Steel Company and the Lindsey & McCutcheon plant of the Carnegie Steel Company started, but not to full capacity. There is a progressive improvement in demand for certain light steel products, including sheets, merchant pipe and wire products, while specifications for steel bars, against old contracts, are showing a further improvement. Track supplies are being bought in somewhat larger volume, but there is no large buying of rails.

A moderate amount of structural work is being placed, chiefly in small jobs. The only fair-sized contracts lately let have been the bridge over the Allegheny river at Oakmont and the First National Bank building, totaling 4000 tons between them.

Pig Iron—The market has been particularly dull in the past few days. While the settlement of the coal strike in Alabama had no direct effect on the Northern market, it has relieved the situation from the fear of Northern iron being bought

to make up for an insufficient supply from the South, and buyers are correspondingly cautious. Purchases are for small lots for early delivery. Most large consumers are fairly well covered. The Valley furnaces adhere to \$14.50, furnace, on No. 2 foundry, equal to \$15.40, Pittsburg, but a couple of western Pennsylvania furnaces are ready to give away enough of their freight advantage to undersell this price by 10 or 15c. a ton in Pittsburg. Bessemer is still quotable at \$15@15.25, Valley; malleable and basic at \$14.50@14.75, Valley, and gray forge at \$13.75, Valley, the freight to Pittsburg being 90 cents.

Steel—The market for billets continues quiet, but the regular mill price of \$25, Pittsburg, is still the market. Sheet-bar shipments to tin mills have fallen off materially in the past fortnight, and sales are light, the price remaining at \$27, Pittsburg. Plates remain at 1.60c. Pittsburg. The regular price of 1.40c. on steel bars is strictly adhered to.

Sheets—Demand is showing a moderate improvement, both from jobbers' stocks and from mills. Prices remain at 2.50c. for black and 3.55c. for galvanized.

Ferro-Manganese—The market remains quiet, with prompt ferromanganese at \$43, seaboard, or \$44.95 Pittsburg, and 50c. to \$1 higher quoted for future deliveries.

Metal Market

Gold and Silver Exports and Imports

NEW YORK, Sept. 9.

At all U. S. Ports in July and year.

| Metal. | Exports. | Imports. | Excess. |
|----------------|--------------|--------------|-------------------|
| Gold: | | | |
| July 1908.. | \$ 4,845,272 | \$ 2,916,408 | Exp. \$ 1,928,864 |
| " 1907.. | 7,478,366 | 3,410,782 | " 4,067,584 |
| Year 1908.. | 58,363,247 | 29,324,304 | " 29,038,943 |
| " 1907.. | 43,779,098 | 24,879,429 | " 18,899,669 |
| Silver: | | | |
| July 1908.. | 4,930,746 | 2,982,074 | Exp. 1,948,672 |
| " 1907.. | 5,955,042 | 3,387,225 | " 2,567,817 |
| Year 1908.. | 30,445,291 | 24,124,422 | " 6,321,869 |
| " 1907.. | 35,174,251 | 25,782,836 | " 9,391,415 |

Exports of specie from New York week ended Sept. 5: Gold, \$400, to Haiti; silver, \$801,785, chiefly to London. Imports: Gold, \$305,049; silver, \$62,046, both from the West Indies, Mexico and South America.

Specie holdings of the leading banks of the world, Sept. 5, are reported, as below, in dollars:

| | Gold. | Silver. | Total. |
|-----------------|---------------|---------------|---------------|
| Ass'd New York | | | \$329,086,500 |
| England..... | \$191,727,200 | | 191,727,200 |
| France..... | 643,488,865 | \$177,701,425 | 821,190,290 |
| Germany..... | 195,230,000 | 80,910,000 | 276,140,000 |
| Spain..... | 78,510,000 | 172,630,000 | 251,140,000 |
| Netherlands.... | 38,530,000 | 20,300,500 | 58,830,500 |
| Belgium..... | 20,016,665 | 10,008,335 | 30,025,000 |
| Italy..... | 184,685,000 | 22,500,000 | 207,185,000 |
| Russia..... | 579,165,000 | 40,530,000 | 619,695,000 |
| Aust.-Hungary.. | 237,305,000 | 66,755,000 | 304,060,000 |
| Sweden..... | 20,405,000 | | 20,405,000 |
| Norway..... | 8,255,000 | | 8,255,000 |
| Switzerland.... | 22,815,000 | | 22,815,000 |

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

The Treasury Department estimates the amount and kinds of money in the United States on Sept. 1 as follows:

| | In Treasury. | In Circul'n. |
|---|----------------------|------------------------|
| Gold coin (inc. bullion in Treasury)..... | \$ 184,003,816 | \$ 619,990,263 |
| Gold certificates..... | 30,911,760 | 806,653,109 |
| Silver dollars..... | 754,487 | 74,891,495 |
| Silver certificates..... | 12,684,277 | 475,083,723 |
| Subsidiary silver..... | 23,774,263 | 124,065,674 |
| Treasury notes of 1890.... | 9,582 | 4,837,418 |
| U. S. notes..... | 5,369,090 | 341,811,926 |
| Nat. bank notes..... | 54,692,308 | 630,633,800 |
| Total..... | \$312,199,983 | \$3,077,406,908 |

Estimated average circulation per capita, \$35.07.

Silver Market

SILVER AND STERLING EXCHANGE.

| Sept. | Sterling Exchange. | Silver. | | Sept. | Sterling Exchange. | Silver. | |
|-------|--------------------|------------------|----------------|-------|--------------------|------------------|----------------|
| | | New York, Cents. | London, Pence. | | | New York, Cents. | London, Pence. |
| 3 | 4.8610 | 51½ | 23½ | 7 | ..... | ..... | 24 |
| 4 | 4.8608 | 51¼ | 23¼ | 8 | 4.8615 | 51½ | 23¼ |
| 5 | 4.8605 | 51½ | 23½ | 9 | 4.8635 | 51½ | 23½ |

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

Purchases for the Indian bazaars carried silver up to 24d., but subsequent operations on speculative account forced the market back to 23¾d., at which figure it closes dull.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to Aug. 27:

| | 1907. | 1908. | Changes. |
|-------------------|-------------------|-------------------|----------------------|
| India..... | £8,086,834 | £6,306,713 | D. £1,780,121 |
| China..... | ..... | 516,400 | I. 516,400 |
| Straits..... | 598,700 | 90,510 | D. 508,190 |
| Total..... | £8,685,534 | £6,913,623 | D. £1,771,911 |

Receipts for the week, £5000 from the West Indies and £162,500 from New York; a total of £167,500.

Copper, Tin, Lead and Zinc

DAILY PRICES OF METALS.

| Sept. | Copper. | | | Tin. | Lead. | Spelter. | |
|-------|--------------------|----------------------------|--------------------|-------|------------|--------------|--------------|
| | Lake, Cts. per lb. | Electrolytic, Cts. per lb. | London, £ per ton. | | | Cts. per lb. | Cts. per lb. |
| 3 | 13½ @13½ | 13½ @13½ | 60½ | 29 | 4.55 @4.60 | 4.70 @4.72½ | 4.55 @4.57½ |
| 4 | 13½ @13½ | 13½ @13½ | 60½ | 28½ | 4.55 @4.60 | 4.70 @4.75 | 4.55 @4.60 |
| 5 | 13½ @13½ | 13½ @13½ | ..... | 28½ | 4.55 @4.60 | 4.70 @4.75 | 4.55 @4.60 |
| 7 | ..... | ..... | 61½ | ..... | ..... | ..... | ..... |
| 8 | 13½ @13½ | 13½ @13½ | 61½ | 28½ | 4.55 @4.60 | 4.75 @4.77½ | 4.60 @4.62½ |
| 9 | 13½ @13½ | 13½ @13½ | 60½ | 28½ | 4.55 @4.60 | 4.75 @4.77½ | 4.60 @4.62½ |

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

Copper—There has been a fair business since Sept. 2, both with foreign and domestic consumers, together with transactions by traders. Electrolytic copper

has been offered by all of the producers at 13¾, delivered, 30 days, or about 13½c., cash, New York, but the transactions have been made at about 13½c., at which figure everyone has been willing to meet buyers. In Lake copper a curious case of disparity of price according to brand has occurred. Up to Sept. 3 a large interest was selling at the equivalent of 13¾c., but the next day raised its price to 14c., nominally, or about 13¾, net, and considerable business was done at that figure and a shade under. At the same time other brands of Lake copper were sold in important quantities at about 13.60c. The higher prices were paid for special brands of copper, wanted by brass manufacturers, who appear to be experiencing a significant improvement in business. The demand for wirebars still lags. However, the capacity of the market to absorb the copper that is offered is undoubtedly increasing. Indeed, manufacturers the world over are doing an increasing business, on the strength of which they are justified in placing orders from day to day. This demand is readily met by all the large sellers and prices close unchanged at 13½@13¾c. for Lake copper; 13½@13¾c. for electrolytic in ingots, cakes and wirebars. The average of the week at which business in casting copper has been done is 13½@13¾ cents.

The character of the London standard market remains the same as it has been for some weeks past. Prices moved up and down a little, but on the whole there is not much change. The close is cabled steady at £60 17s. 6d. for spot, £61 15s. for three months.

Refined and manufactured sorts we quote: English tough, £63 10s.@£64 10s.; best selected, £63 10s.@£64 10s.; strong sheets, £75 10s.@£76 10s.

Tin—The market in London has been kept steady throughout the week by operators over there, notwithstanding an absolute dearth of orders from this side. The close from there is cabled at £130 15s. for spot, £132 for three months.

The market does not seem to be able to awaken from its lethargy, and business continues to be of a retail character only. The tendency in general is bearish, as a falling off in consumption is expected during this and next month, due to the closing down of some of the tinplate mills. Spot tin can be bought at the close at around 28½ cents.

Lead—Business is almost at a standstill. Prices close barely steady at 4.55@4.60c. New York. Missouri lead is selling at St. Louis at 4.42½ cents.

Prices in London are still dropping, and the close is weak at £13 1s. 3d. for Spanish lead, £13 3s. 9d. for English lead.

Spelter—The improvement in the position of this metal is becoming more and more apparent. The accumulations at the smelting works are fast disappearing, owing to a consumption which is in excess

of the current output. The close is firm and higher at 4.60@4.62½c. St. Louis, 4.75 @4.77½c. New York.

The London market is unchanged at £19 7s. 6d. for good ordinaries, £19 12s. 6d. for specials.

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

Other Metals

Antimony—The market continues dull with little business doing. Prices are rather weak at 8½@8¼c. for Cookson's; 7¾@8c. for Halletts; 7½@7¾c. for ordinary brands.

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

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

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

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

Platinum—Offers of the metal continue to be made at \$17.50@19. Scrap is about \$15.50 per ounce.

German Metal Imports and Exports

Imports and exports of metals in Germany for the six months ended June 30 are reported as follows, in metric tons; the figures including alloys and manufactures of the several metals:

| | Imports. | Exports. | Excess. |
|-----------------|----------|----------|-------------|
| Copper..... | 90,979 | 35,570 | Imp. 55,409 |
| Copper, 1907.. | 68,171 | 30,128 | Imp. 38,043 |
| Tin..... | 7,685 | 2,930 | Imp. 4,755 |
| Tin, 1907..... | 6,611 | 3,489 | Imp. 3,122 |
| Lead..... | 35,962 | 21,228 | Imp. 14,734 |
| Lead, 1907..... | 37,304 | 17,336 | Imp. 19,968 |
| Zinc..... | 14,482 | 42,177 | Exp. 27,695 |
| Zinc, 1907..... | 15,320 | 45,354 | Exp. 30,034 |
| Nickel..... | 1,572 | 979 | Imp. 593 |
| Nickel, 1907.. | 1,193 | 646 | Imp. 547 |
| Aluminum..... | 1,248 | 545 | Imp. 703 |
| Aluminum, '07. | 1,948 | 1,096 | Imp. 882 |
| Minor metals... | 512 | 4,738 | Exp. 4,226 |
| Minor met's '07 | 452 | 4,607 | Exp. 4,155 |

Imports and exports of ores and minerals, other than iron ore, for the six months were, in metric tons:

| | Imports. | Exports. | Excess. |
|-----------------|----------|----------|--------------|
| Gold ore..... | 22 | ..... | Imp. 22 |
| Silver ore..... | 920 | ..... | Imp. 920 |
| Copper ore..... | 7,032 | 15,016 | Exp. 7,984 |
| Tin ore..... | 4,902 | 25 | Imp. 4,877 |
| Lead ore..... | 66,801 | 505 | Imp. 66,296 |
| Zinc ore..... | 91,574 | 13,145 | Imp. 78,429 |
| Nickel ore..... | 6,082 | ..... | Imp. 6,082 |
| Tungsten ore... | 1,012 | 62 | Imp. 950 |
| Chrome ore..... | 9,651 | 23 | Imp. 9,628 |
| Pyrates..... | 298,778 | 6,357 | Imp. 292,421 |

Imports of slag and slag products were 295,400 tons; exports, 39,007 tons.

Wisconsin Ore Market

Platteville, Wis., Sept. 5—The base price paid this week for zinc ore was \$36@37 per ton of 60 per cent. zinc. For 80 per

cent. lead ore \$60 per ton was paid. Shipments for week ended Sept. 5 were:

| Camps. | Zinc ore, lb. | Lead ore, lb. | Sulphur ore, lb. |
|----------------------|---------------|---------------|------------------|
| Hazel Green..... | 425,010 | ..... | ..... |
| Benton..... | 381,720 | 65,610 | ..... |
| Platteville..... | 366,000 | 64,170 | ..... |
| Strawbridge..... | 264,440 | ..... | ..... |
| Cuba City..... | 240,000 | 88,000 | ..... |
| Mineral Point..... | 183,350 | ..... | ..... |
| Highland..... | 182,450 | ..... | ..... |
| Harker..... | 109,270 | ..... | ..... |
| Days Siding..... | 88,000 | ..... | ..... |
| Livingston..... | 80,000 | ..... | ..... |
| Galena..... | 59,400 | ..... | ..... |
| Linden..... | ..... | ..... | 56,190 |
| Total..... | 2,379,640 | 217,780 | 56,190 |
| Year to Sept. 5..... | 64,964,491 | 7,555,945 | 1,318,204 |

There was shipped last week, not then reported, from Linden, 201,680 lb.; from Harker, 61,870 lb.; from Highland, 314,800 lb. zinc ore. In addition to the above there was shipped this week to the Joplin Separator Works at Galena, 195,100 lb., and to the Enterprise roaster, at Platteville, 88,000 lb. of zinc concentrates.

Missouri Ore Market

Joplin, Mo., Sept. 5—No sale higher than a \$37 base price was reported in the zinc market, but there was very little ore sold under a \$37 base, the few bins purchased at a lower price being small and of a grade not to attract general attention. The silicate market is the strongest, the base price this week being \$20 per ton of 40 per cent. zinc, and the high price was \$28 per ton on this base. It is the highest base reported for this mineral, and is conceded to be out of all proportion to the market for blende. The average price, all grades, was \$34.28. With one lead smelter out of the market and another buying lightly the market was still strong with spirited competition between the two companies purchasing. The highest price was \$59, and a large amount of the shipment was purchased at this figure. The average price, all grades, was \$58.70 per ton.

Outputting is strong and is now approaching 6000 tons per week.

Following are the shipments of zinc and lead ore for the week ending Sept. 5:

| | Zinc, lb. | Lead, lb. | Value. |
|--|-------------|------------|-------------|
| Webb City-Carterville | 3,686,450 | 529,780 | \$80,139 |
| Joplin..... | 2,221,500 | 242,670 | 46,926 |
| Galena..... | 640,200 | 105,500 | 14,289 |
| Alba-Neck..... | 526,790 | ..... | 9,218 |
| Spurgeon..... | 296,160 | 135,700 | 8,685 |
| Granby..... | 533,000 | 25,000 | 8,050 |
| Duenweg..... | 267,670 | 95,200 | 7,491 |
| Oronogo..... | 381,510 | ..... | 7,254 |
| Aurora..... | 396,910 | 16,550 | 7,033 |
| Prosperity..... | 285,880 | 52,120 | 6,537 |
| Miami..... | 392,310 | 62,710 | 5,718 |
| Quapaw..... | 361,140 | ..... | 5,056 |
| Carthage..... | 195,050 | ..... | 3,618 |
| Sarcoxi..... | 143,090 | ..... | 2,575 |
| Carl Junction..... | 91,220 | ..... | 1,687 |
| Zincite..... | 94,820 | ..... | 1,659 |
| Ozark..... | 23,040 | ..... | 184 |
| Totals..... | 10,436,740 | 1,265,230 | \$216,119 |
| 36 weeks..... | 339,529,910 | 52,529,820 | \$7,167,854 |
| Zinc value, the week, \$178,982; 36 weeks, \$5,714,714 | | | |
| Lead value, the week, 37,137; 36 weeks, 1,453,140 | | | |

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

| Month. | ZINC ORE. | | | | LEAD ORE. | |
|----------------|-------------|---------|-----------|---------|-----------|---------|
| | Base Price. | | All Ores. | | All Ores. | |
| | 1907. | 1908. | 1907. | 1908. | 1907. | 1908. |
| January..... | \$46.90 | \$37.60 | \$45.84 | \$35.56 | \$83.58 | \$46.88 |
| February..... | 48.30 | 36.63 | 47.11 | 34.92 | 84.58 | 49.72 |
| March..... | 49.75 | 36.19 | 48.66 | 34.19 | 82.75 | 49.90 |
| April..... | 49.25 | 35.40 | 48.24 | 34.08 | 79.76 | 52.47 |
| May..... | 46.90 | 34.19 | 45.98 | 33.39 | 79.56 | 56.05 |
| June..... | 47.00 | 33.06 | 44.82 | 32.07 | 73.66 | 60.48 |
| July..... | 46.80 | 34.55 | 45.79 | 31.67 | 58.18 | 59.90 |
| August..... | 44.56 | 36.53 | 43.22 | 33.42 | 59.54 | 60.34 |
| September..... | 41.00 | ..... | 40.11 | ..... | 53.52 | ..... |
| October..... | 41.75 | ..... | 39.83 | ..... | 51.40 | ..... |
| November..... | 38.60 | ..... | 35.19 | ..... | 43.40 | ..... |
| December..... | 31.50 | ..... | 30.87 | ..... | 37.71 | ..... |
| Year..... | \$44.36 | ..... | \$43.68 | ..... | \$68.90 | ..... |

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

Chemicals

New York, Sept. 9—There is no material change in the general market. Spot business continues quiet, but there seems to be more inquiries about contract business. There is little change in prices.

Copper Sulphate—Business is fair. Prices are unchanged and firm at \$4.65 per 100 lb. for carload lots or over, and \$4.90 for smaller parcels.

Nitrate of Soda—Messrs. Mortimer & Wisner, New York, report the position of nitrate in the United States Sept. 1 as follows, in long tons:

| | 1907. | 1908. | Changes.. |
|---------------------------|---------|---------|-----------|
| Stocks, Jan. 1..... | 13,050 | 5,900 | D. 7,150 |
| Imports, 8 months..... | 221,945 | 179,450 | D. 41,895 |
| Total Supplies..... | 234,395 | 185,350 | D. 49,045 |
| Deliveries, 8 months..... | 229,850 | 175,600 | D. 54,250 |
| Stocks, Sept. 1..... | 4,545 | 9,750 | I. 5,205 |
| Afloat for U. S..... | 100,000 | 75,000 | D. 25,000 |

Nitrate reported afloat includes all cargoes from the west coast of South America due to arrive at United States ports by Dec. 15 next.

Phosphates—Paul C. Trenholm reports shipments of phosphate rock from Charleston, S. C., in August at 3872 tons by rail. No Coastwise shipments.

Mining Stocks

New York, Sept. 9—The stock markets were broken up by a double holiday this week, having adjourned from Friday over to Tuesday. After the holiday, however, there was a strong market, with advancing prices. It is said that there has been more outside buying, but the exchange still shows many evidences of professional work.

On the Curb, mining stocks—especially copper—were inclined to be strong after the holiday. Several of the more active stocks showed gains, and the general tendency of the market was upward.

Boston

Sept. 8—It has been a short and dull week, and price movements have been unimportant. It is literally a waiting mar-

ket, with the trend of prices upward. There was a period of weakness, but prices have recovered. The declaration of dividends by the Calumet & Hecla and the Wolverine companies—of \$5 each—has had no effect, as both were the same as the previous payments. Atlantic had a sharp upward movement from \$14.75 to \$18.25, with some reaction. This was due to the reports of the striking of rich copper ground. Amalgamated fell \$3.25 to \$77.37½, but recovered to above \$80. Adventure fell \$1.12½ to \$8 on belated profit taking, but is back close to \$9 again. Copper Range fell \$1.50 to \$78.50, and North Butte \$3.50 to \$84.75, but the latter went to above \$87 again.

Old Dominion made a low record at \$41.62½, later bringing \$43. The Bigelow suit does not enter as a market factor to any extent in Old Dominion. Arizona Commercial is up over \$2 for the week to \$28.12½. Boston & Corbin has lost \$1 to \$16.75 on desultory trading. Lake Copper advanced \$1.25, touching \$13.37½. Several smaller companies are adopting the plan of issuing bonds convertible into stock, which seems to be a popular one of late. The Curb has shown unimportant price changes, except Superior & Boston, which sold up \$2.50 to \$9.37½. This company will issue 50,000 of an authorized increase of 100,000 shares at \$5 in the proportion of one new share for three held. Application has been made to list Utah-Apex on the Stock Exchange. The Davis-Daly reorganization plan calling for a \$2 assessment has been ratified by stockholders, 319,000 shares voting for it.

STOCK QUOTATIONS

| NEW YORK Sept. 8 | | BOSTON Sept. 8 | |
|------------------------|------|------------------------|------|
| Name of Comp. | Clg. | Name of Comp. | Clg. |
| Alaska Mine..... | 80 | Adventure..... | 8½ |
| Amalgamated..... | 77½ | Allouez..... | 336 |
| Anacnda..... | 47½ | Am. Zinc..... | 327½ |
| Balaklala..... | 32½ | Arcadian..... | 4 |
| British Col. Cop..... | 7½ | Arizona Com..... | 27½ |
| Butte & London..... | 26½ | Atlantic..... | 16½ |
| Butte Coalition..... | 26½ | Bingham..... | 50 |
| Colonial Silver..... | 13 | Boston Con..... | 13 |
| Cum. Ely Mining..... | 8½ | Calumet & Ariz*..... | 122½ |
| Davis Daly..... | 2½ | Calumet & Hecla*..... | 655 |
| Dominion Cop..... | 2½ | Centennial..... | 333 |
| Douglas Copper..... | 14 | Con. Mercur..... | 42 |
| El Rayo..... | 3 | Copper Range*..... | 79 |
| Florence..... | 318 | Daly West..... | 9½ |
| Foster Cobalt..... | 50 | Franklin..... | 14 |
| Furnace Creek..... | 19 | Greene-Can..... | 11½ |
| Giroux..... | 4½ | Isle Royal..... | 24 |
| Gold Hill..... | 3 | La Salle..... | 14½ |
| Goldfield Con..... | 6½ | Mass..... | 6½ |
| Granby..... | 105 | Michigan..... | 14½ |
| Greene Gold..... | 1½ | Mohawk..... | 66½ |
| Greene G. & S..... | 1½ | Nevada..... | 16½ |
| Greenw'r & D. Val..... | 175 | North Butte..... | 86½ |
| Guanajuato..... | 12½ | Old Colony..... | 65 |
| Guggen. Exp..... | 170 | Old Dominion..... | 42½ |
| Hanapah..... | 20 | Osceola..... | 110 |
| McKinley Dar..... | 2 | Parrot..... | 27 |
| Micmac..... | 2½ | Quincy..... | 95 |
| Mines Co. of Am..... | 17½ | Rhode Island..... | 34½ |
| Mitchell Mining..... | 1½ | Santa Fe..... | 2 |
| Mont. Sho. C..... | 1½ | Shannon..... | 15½ |
| Nev. Utah M. & S..... | 3½ | Superior..... | 24½ |
| Newhouse M. & S..... | 6½ | Tamarack..... | 75½ |
| Nipissing Mines..... | 8½ | Trinity..... | 20 |
| Old Hundred..... | 3 | United Cop., com..... | 110½ |
| Silver Queen..... | 1.05 | U. S. Oil..... | 125½ |
| Stewart..... | 3 | U. S. Smg. & Ref..... | 41½ |
| Tennessee Cop'r..... | 38½ | U.S.Sm. & Re., pd..... | 45½ |
| Tri-Bullion..... | 17½ | Utah Con..... | 47 |
| Union Copper..... | 118 | Victoria..... | 5½ |
| Utah Apex..... | 14½ | Winona..... | 16 |
| Utah Copper..... | 45½ | Wolverine..... | 145 |
| Yukon Gold..... | 5½ | Wyandotte..... | 2½ |

*Ex. Div. †Ex. Rights.

‡Last quotation.

| N. Y. INDUSTRIAL | | ST. LOUIS Sept. 5 | |
|---------------------------|------|--------------------|---------------|
| Name of Comp. | Clg. | Name of Comp. | Clg. |
| Am. Agri. Chem..... | 27½ | N. of Com..... | High. Low. |
| Am. Smelt. & Ref..... | 95½ | Adams..... | .40 .30 |
| Am. Sm. & Ref., pf..... | 106½ | A. M. Nettie..... | .05 .03 |
| Bethlehem Steel..... | 23 | Center Cr'k..... | 2.50 1.75 |
| Colo. Fuel & Iron..... | 36½ | Cent. C. & C..... | 68.00 66.00 |
| Federal M. & S., pf..... | 185 | C. C. & C. pd..... | 76.00 74.00 |
| Inter. Salt..... | 118½ | Cent. Oil..... | 110.00 100.00 |
| National Lead..... | 84½ | Columbia..... | 5.00 4.00 |
| National Lead, pf..... | 101½ | Con. Coal..... | 20.00 19.00 |
| Pittsburg Coal..... | 112 | Doe Run..... | 125.00 110.00 |
| Republic I. & S..... | 24 | Gra. Bimet..... | .18 .16 |
| Republic I. & S., pf..... | 81½ | St. Joe..... | 15.00 12.50 |
| Sloss-Sheffield..... | 64 | | |
| Standard Oil..... | 1635 | | |
| U. S. Red. & Ref..... | 115½ | | |
| U. S. Steel..... | 48 | | |
| U. S. Steel, pf..... | 111½ | | |
| Va. Car. Chem..... | 29 | | |

| NEVADA STOCKS. Sept. 9. | | | |
|--|-------|------------------------|-------|
| Furnished by Weir Bros. & Co., New York. | | | |
| Name of Comp. | Clg. | Name of Comp. | Clg. |
| COMSTOCK STOCKS | | | |
| Belcher..... | .18 | Silver Pick..... | .19 |
| Best & Belcher..... | .47 | St. Ives..... | .27 |
| Caledonia..... | .19 | Triangle..... | .05 |
| Chollar..... | .18 | BULLFROG STOCKS | |
| Comstock..... | 1.26 | Bullfrog Mining..... | .03 |
| Con. Cal. & Va..... | .82 | Bullfrog Nat. B..... | .04 |
| Crown Point..... | .26 | Gold Bar..... | .05 |
| Exchequer..... | .22 | Homestake King..... | .20 |
| Gould & Curry..... | .08 | Montgomery Mt..... | .04 |
| Hale & Norcross..... | .28 | Mont. Shoshone C..... | .87½ |
| Mexican..... | .62 | Original Bullfrog..... | .01 |
| Ophir..... | 2.02½ | Tramp Cons..... | .17 |
| Overman..... | .12 | MANHATTAN STOCKS | |
| Potosi..... | .20 | Manhattan Cons..... | .08 |
| Savage..... | .26 | Manhatt'n Dexter..... | .06 |
| Sierra Nevada..... | .25 | Jumping Jack..... | .03 |
| Union..... | .21 | Stray Dog..... | .03 |
| Utah..... | .05 | MISCELLANEOUS | |
| Yellow Jacket..... | .52 | Golden Boulder..... | .07 |
| TONOPAH STOCKS | | | |
| Belmont..... | 1.00 | Bonnie Clare..... | .08 |
| Extension..... | .72 | Lee Gold Grotto..... | ... |
| Golden Anchor..... | .02 | Nevada Hills..... | 1.37½ |
| Jim Butler..... | .26 | Nevada Smelting..... | 1.00 |
| MacNamara..... | .53 | Pittsburgh S. Pk..... | 1.00 |
| Midway..... | .31 | Round Mt. Sphinx..... | .15 |
| Montana..... | 1.30 | | |
| North Star..... | .08 | | |
| Tono'h Mine of N..... | 7.25 | | |
| West End Con..... | .57 | | |

| GOLDFIELD STOCKS | | | |
|-------------------------|------|----------------------|------|
| Name of Comp. | Clg. | Name of Comp. | Clg. |
| Acacia..... | 6½ | Black Bell..... | ... |
| Atlanta..... | .28 | C. C. Con..... | 3½ |
| Booth..... | .43 | Dante..... | 6½ |
| Columbia Mt..... | .28 | Doctor Jack Pot..... | 6½ |
| Comb. Frac..... | 1.48 | Elkton..... | 61½ |
| Cracker Jack..... | .07 | El Paso..... | 39½ |
| Dia'dfield B. B. C..... | 16½ | Findlay..... | 22 |
| Goldfield Belmont..... | 15 | Gold Dollar..... | 16½ |
| Goldfield Daisy..... | 72 | Gold Sovereign..... | 33 |
| Great Bend..... | 31 | Isabella..... | 29½ |
| Jumbo Extension..... | 41 | Index..... | ... |
| Katherine..... | 41 | Jennie Sample..... | 2½ |
| Kendall..... | 15 | Jerry Johnson..... | 14 |
| Lone Star..... | 10 | Mary McKinney..... | 27 |
| May Queen..... | 06 | Pharmacist..... | 3½ |
| Oro..... | 13 | Portland..... | 1.00 |
| Red Hill..... | 28 | Un. Gold Mines..... | 4½ |
| Roanoke..... | 27 | Vindicator..... | 84 |
| Sandstorm..... | 27 | Work..... | 8½ |

| Assessments | | | |
|--------------------------|----------|----------|--------|
| Company. | Delinq. | Sale. | Amt. |
| Alta, Nev..... | Aug. 25 | Sept. 15 | \$0.05 |
| Belcher, Nev..... | Sept. 15 | Oct. 6 | 0.10 |
| Caledonia, Nev..... | Aug. 12 | Sept. 2 | 0.05 |
| Challenge Con., Nev..... | Aug. 31 | Sept. 22 | 0.05 |
| Con. Imperial, Nev..... | Sept. 29 | Oct. 22 | 0.01 |
| Exchequer, Nev..... | Aug. 11 | Sept. 1 | 0.05 |
| Hale & Norcross, N..... | Sept. 3 | Sept. 24 | 0.10 |
| Julia, Nev..... | Aug. 21 | Sept. 14 | 0.03 |
| Little Chief, Utah..... | Aug. 11 | Sept. 1 | 0.01 |
| Overman, Nev..... | Sept. 23 | Oct. 14 | 0.05 |
| Potosi, Nev..... | Sept. 4 | Sept. 29 | 0.10 |
| Savage, Nev..... | Aug. 27 | Sept. 18 | 0.10 |
| Scorpion, Nev..... | Aug. 11 | Sept. 3 | 0.02 |
| Signet..... | Aug. 8 | Oct. 6 | 0.01 |
| Talisman, Utah..... | Aug. 1 | Aug. 18 | 0.02 |
| Tomahawk, Nev..... | July 10 | Aug. 12 | 0.01 |
| Union Con., Nev..... | Sept. 15 | Oct. 7 | 0.10 |
| Utah, Nev..... | Aug. 12 | Sept. 2 | 0.03 |
| Wheeler, Utah..... | July 16 | Aug. 6 | 0.01½ |
| Yellow Jacket, Nev..... | Aug. 10 | Sept. 15 | 0.25 |

| Monthly Average Prices of Metals | | | | |
|----------------------------------|-----------|--------|---------|--------|
| SILVER | | | | |
| Month. | New York. | | London. | |
| | 1907. | 1908. | 1907. | 1908. |
| January..... | 68.673 | 55.678 | 31.769 | 25.738 |
| February..... | 68.835 | 56.000 | 31.852 | 25.855 |
| March..... | 67.519 | 55.365 | 31.325 | 25.570 |
| April..... | 65.462 | 54.506 | 30.253 | 25.133 |
| May..... | 65.971 | 52.795 | 30.471 | 24.377 |
| June..... | 67.090 | 53.663 | 30.893 | 24.760 |
| July..... | 68.144 | 53.115 | 31.366 | 24.514 |
| August..... | 68.745 | 51.683 | 31.637 | 23.858 |
| September..... | 67.792 | ..... | 31.313 | ..... |
| October..... | 62.435 | ..... | 28.863 | ..... |
| November..... | 58.677 | ..... | 27.154 | ..... |
| December..... | 54.565 | ..... | 25.362 | ..... |
| Year..... | 65.327 | ..... | 30.188 | ..... |

New York, cents per fine ounce; London, pence per standard ounce.

| COPPER | | | | | | |
|----------------|--------------|--------|---------|--------|---------|--------|
| Month. | NEW YORK. | | LONDON. | | 1907. | 1908. |
| | Electrolytic | Lake. | 1907. | 1908. | | |
| January..... | 24.404 | 13.726 | 24.825 | 13.901 | 106.739 | 62.386 |
| February..... | 24.869 | 12.905 | 25.236 | 13.098 | 107.356 | 58.786 |
| March..... | 25.065 | 12.704 | 25.560 | 12.875 | 106.594 | 58.761 |
| April..... | 24.224 | 12.743 | 25.260 | 12.928 | 98.625 | 58.331 |
| May..... | 24.048 | 12.598 | 25.072 | 12.788 | 102.375 | 57.387 |
| June..... | 21.665 | 12.675 | 24.140 | 12.877 | 97.272 | 57.842 |
| July..... | 22.130 | 12.702 | 21.123 | 12.933 | 95.016 | 57.989 |
| August..... | 18.356 | 13.462 | 19.255 | 13.639 | 79.679 | 60.500 |
| September..... | 15.565 | ..... | 16.047 | ..... | 68.375 | ..... |
| October..... | 13.169 | ..... | 13.551 | ..... | 60.717 | ..... |
| November..... | 13.391 | ..... | 13.870 | ..... | 61.226 | ..... |
| December..... | 13.163 | ..... | 13.393 | ..... | 60.113 | ..... |
| Year..... | 20.004 | ..... | 20.661 | ..... | 87.007 | ..... |

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

| TIN AT NEW YORK | | | | | |
|-----------------|--------|--------|----------------|--------|--------|
| Month. | 1907. | 1908. | Month. | 1907. | 1908. |
| January..... | 41.548 | 27.380 | July..... | 41.091 | 29.207 |
| February..... | 42.102 | 28.978 | August..... | 37.667 | 29.942 |
| March..... | 41.313 | 30.577 | September..... | 36.689 | ..... |
| April..... | 40.938 | 31.702 | October..... | 32.620 | ..... |
| May..... | 43.149 | 30.015 | November..... | 30.833 | ..... |
| June..... | 42.120 | 28.624 | December..... | 27.925 | ..... |
| | | | Av. year..... | 38.166 | ..... |

Prices are in cents per pound.

| LEAD | | | | |
|----------------|-----------|-------|---------|--------|
| Month. | New York. | | London. | |
| | 1907. | 1908. | 1907. | 1908. |
| January..... | 6.000 | 3.691 | 19.828 | 14.469 |
| February..... | 6.000 | 3.725 | 19.531 | 14.250 |
| March..... | 6.000 | 3.838 | 19.703 | 13.975 |
| April..... | 6.000 | 3.993 | 19.975 | 13.469 |
| May..... | 6.000 | 4.253 | 19.688 | 12.938 |
| June..... | 5.760 | 4.466 | 20.188 | 12.000 |
| July..... | 5.288 | 4.447 | 20.350 | 13.000 |
| August..... | 5.250 | 4.580 | 19.683 | 13.375 |
| September..... | 4.813 | ..... | 19.775 | ..... |
| October..... | 4.750 | ..... | 18.531 | ..... |
| November..... | 4.376 | ..... | 17.281 | ..... |
| December..... | 3.658 | ..... | 14.500 | ..... |
| Year..... | 5.325 | ..... | 19.034 | ..... |

New York, cents per pound. London, pounds sterling per long ton.

| SPELTER | | | | | | |
|----------------|-----------|-------|------------|-------|---------|--------|
| MONTH. | New York. | | St. Louis. | | London. | |
| | 1907. | 1908. | 1907. | 1908. | 1907. | 1908. |
| January..... | 6.732 | 4.513 | 6.582 | 4.363 | 27.125 | 20.563 |
| February..... | 6.814 | 4.788 | 6.664 | 4.638 | 25.938 | 20.875 |
| March..... | 6.837 | 4.665 | 6.687 | 4.527 | 26.094 | 21.075 |
| April..... | 6.685 | 4.645 | 6.535 | 4.495 | 25.900 | 21.344 |
| May..... | 6.441 | 4.608 | 6.291 | 4.458 | 25.563 | 19.906 |
| June..... | 6.419 | 4.543 | 6.269 | 4.393 | 25.469 | 19.000 |
| July..... | 6.072 | 4.485 | 5.922 | 4.338 | 23.850 | 19.031 |
| August..... | 5.701 | 4.702 | 5.561 | 4.556 | 21.969 | 19.350 |
| September..... | 5.236 | ..... | 5.086 | ..... | 21.050 | ..... |
| October..... | 5.430 | ..... | 5.280 | ..... | 21.781 | ..... |
| November..... | 4.925 | ..... | 4.775 | ..... | 21.438 | ..... |
| December..... | 4.254 | ..... | 4.104 | ..... | 20.075 | ..... |
| Year..... | 5.962 | ..... | 5.812 | ..... | 23.771 | ..... |