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## Construction of an All-Steel Dredge--I

BY LEWIS H. EDDY\*

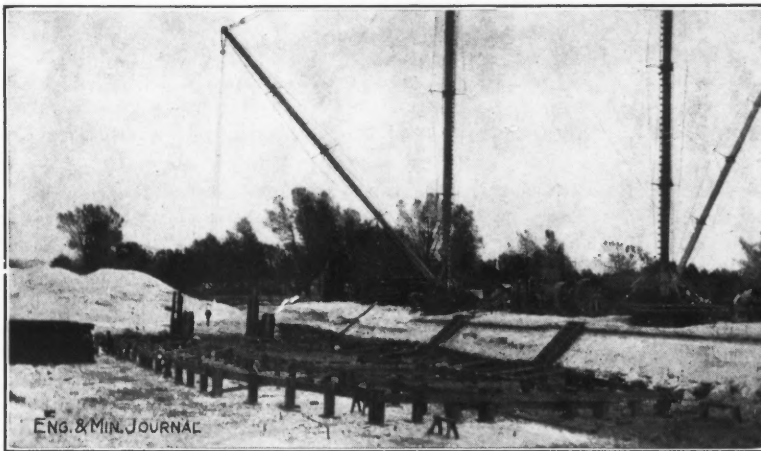
*SYNOPSIS*—Yuba No. 14 all-steel 16-cu.ft. bucket-elevator gold-placer dredge, at Hammonton, Calif., has a hull 155 ft. 6 in. long, 58 ft. beam; and is designed to dig 65 ft. below the water line. The total weight of dredge, 2090 tons. This is the largest placer dredge in America, and probably the largest in the world. The dredge was built by the Yuba Construction Co., P. R. Parker, engineer in charge, and constructed under the superintendency of Paul E. Morse. It was completed and ready for digging on Dec. 17, 1913, four months and four days, elapsed time. The dredge is owned and operated by Yuba Consolidated Goldfields, George J. Carr, division manager; M. L. Sumner, dredgemaster.

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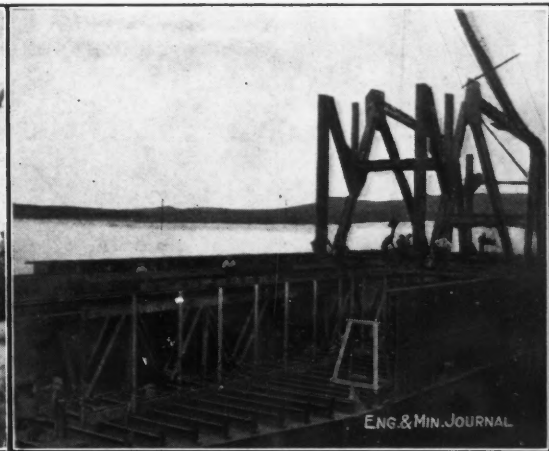
Construction of the steel hull of Yuba No. 14 all-steel 16-cu.ft. dredge at Hammonton, Calif., began with the initial riveting of bottom plates on Aug. 13, 1913. The

A large amount of assembling and riveting, including the stacker and main hopper, and making riffles, formed a part of the labor in the construction camp, reducing the weight and bulk of loads handled in transportation and affording convenient and economic distribution of labor. Delivery of materials was in progress from the beginning of the hull foundation. The first part of the haul was over the Western Pacific Ry. to Cleveland spur, two miles south of Marysville. The materials were transferred by two hand-derricks from the cars to trucks hauled by a 65-hp. caterpillar type engine. The distance from the spur to the dredge camp is 12 miles. The trip was made between the two points at the rate of  $2\frac{1}{2}$  miles per hr. loaded and  $4\frac{1}{2}$  miles per hr. unloaded.

The wooden foundation on which the hull was laid was finished on Aug. 4. There were 120 posts in the foundation, placed an average of 8 ft. 3 in. apart, between cen-



WOODEN FOUNDATION. LAYING BOTTOM PLATES OF HULL



ERECTING THE STEEL FRAME

hull was ready for flotation on Sept. 15, but was not floated until Sept. 17, owing to an insufficiency of water in the pond. Thirty-two days elapsed time is the record for steel-hull construction, an especially notable record considering the building of a steel deck requires 15 days more time than a wooden deck. The completed dredge was ready for digging Dec. 17, 1913, making a record of four months and four days.

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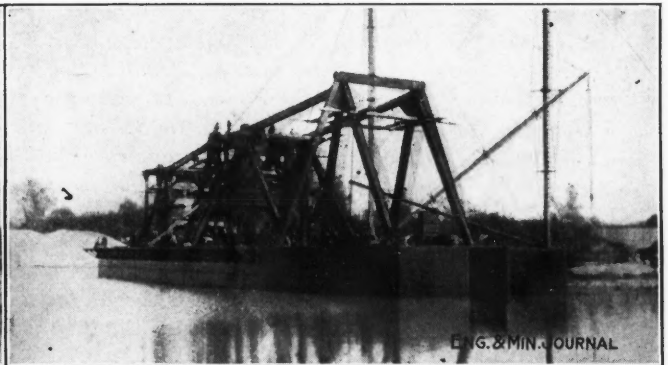
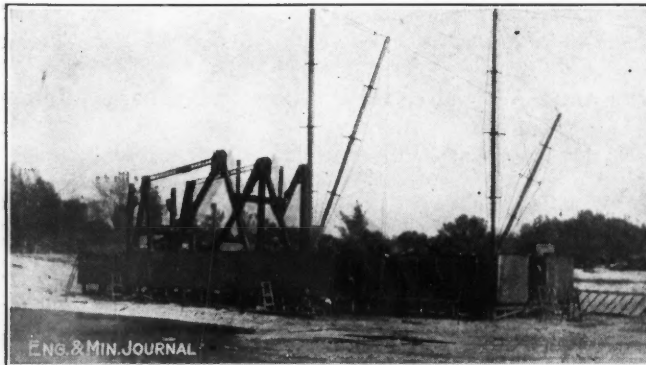
ters. They were 3 ft. 6 in. high, set on blocks made of 3x12-in. planking, making a total height of 4 ft. A single row of posts was set under each of the two lower steel chords; a single row along each side; double rows under the bow, under the forward truss posts, under the well hole and athwartship under the stern. The posts were braced fore and aft with 3x12-in. planks fastened to each post with  $1\frac{3}{4}$ -in. iron bolts. These planks were afterward used for staging on and around the hull when the boat was floated. The posts were wired together in

strings commencing at the center; one set of lines going forward, one set going aft. Each post and each footing block was fastened to the lines by staples, and the posts and blocks were counted and a record kept to make sure they were all pulled out when the hull was floated. Old  $\frac{3}{4}$ -in. cable was used for lines, which were run through shore sheaves and attached to the two derricks standing one off the bow and one off the stern of the boat. As the posts and blocks were pulled out the hull took the water without the slightest jar, the deck riveters and other workmen proceeding with their labor without being aware that the boat was afloat.

The hull is 155 ft. 6 in. long, 58-ft. beam, 5 ft. overhang on each side, 6 ft. overhang at stern, 11 ft. 6 in. deep; well hole, 8 ft.  $3\frac{1}{2}$  in. wide in the clear; bow ends of well-hole pontoons, 15 ft. wide each; weight of hull 743 tons. The frame of the hull is composed of 146 side and end verticals, two lower and two upper chords, floor sills, stringers, beams, posts and braces. The steel plating in the hull was made in various convenient sizes, and when laid or set up the parts were bolted into place ready for riveting as construction proceeded. The bottom of the hull is made of  $\frac{3}{8}$ -in. plating forward and amidships and of  $\frac{1}{2}$ -in. plating at the stern. The side plates

The floor sills, or floors as they are commonly termed, extend from the side frame of the hull to the lower chords, are riveted to the bottom plates, and are constructed of 15-in. 33-lb. channels, except between the lower chords at the fore-and-aft trusses and the sides of the well hole which are of 10-in. 15-lb. channels. The deck beams are 10-in. 15-lb. channels extending from the sides of the hull to the upper hull chords. Between the sides of the hull and the fore-and-aft trusses 10-in. 15-lb. channels extend longitudinally in two sets, one set on top of the floors, the other set underneath the deck beams. These are tied together at every alternate frame with angle stanchions. Two lines of stringer channels are run the entire length of the hull, one through the center of each side of the hull, on top of the floors; and two lines underneath the deck beams. These channels are connected at every alternate frame with vertical angles. Another line of stringer channels runs through the center of the hull from aft of the well hole to the stern. These channels are 10-in. 15-lb.; the angles are  $6 \times 6 \times \frac{3}{8}$  in.

The plating composing the deck, which is the first steel deck ever built for a placer dredge, was bolted in place and then riveted together and also riveted to the deck beams and the upper hull chords with  $\frac{5}{8}$ -in. rivets



HULL NEARING COMPLETION

HULL AFLOAT. SHOWING MAIN GANTRY, TRUSSING AND FORWARD END OF WELLHOLE

at both bow and stern are  $\frac{3}{8}$  in. thick. The well hole is built of  $\frac{3}{4}$ -in. plating. The wearing plates in the well hole are 1 in. thick, and the wearing plates on the outside of the well-hole pontoons and on the bottoms and corners are  $\frac{1}{2}$  in. thick. The main part of the deck plating is  $\frac{1}{4}$  in. thick, and along the sides and at the well-hole pontoons  $\frac{3}{8}$ -in. deck plating is used.

The two lower chords are of box-girder type, built of 15-in. channels 15 in. apart and extending the entire length of the hull on each side of the center line. The distance between the two chords, c. to c., is 18 ft. 9 in. These chords are built and laid each in four sections, one 30 ft. 3 in. long, one 52 ft. 4 in., one 14 ft. 8 in., one 39 ft. 3 in. The two upper chords are solid box-girder type, extending forward of the main gantry, built of two 15-in. channels connected for their entire length with a cover-plate. Aft of the main gantry the two upper chords are lattice-girder type, built of two 15-in. channels latticed together. The upper chords are connected to the posts by gusset plates, using 1-in. rivets.

The vertical frames for the sides, ends and well hole are made of 8-in. 11.25-lb. channels, generally set 2 ft. 8 in. apart between centers, and in some parts closer. There are 58 verticals on each side, 5 on each bow, 20 across the stern, a total of 146 side and end verticals.

placed 4 in. apart. The deck overhangs are supported by structural-steel brackets situated on alternate frames, except in the way of the pumps where they are placed on every frame in order to take care of these concentrated loads. They are plain brackets made of angles and gussets, so arranged as to stand opposite each inside brace. The inside braces are 3x4-in. angles connected to the side posts and deck beams. The deck beams are connected to the side posts, and the floors are connected to the side posts by inside beams. The overhang extends 5 ft. on each side of the hull; the overhang at the stern is 6 ft.

The trussing and bulkheading are especially strong and designed to meet every possible stress and provide sufficient support for the heavy machinery. The hull is stiffened longitudinally by two trusses extending the full length of the dredge, and transversely by a cross-truss at the upper tumbler and a cross-truss at the forward end of the main housing. These trusses are built entirely of steel. They support the machinery where necessary and take care of the general stresses to which they are subjected. Steel bulkheads extend along the inboard sides of the fore-and-aft trusses on each side of the well hole and between the trusses on the third frame of the well hole. There is a steel bulkhead also extending the full width of the dredge on the third frame



forward of the stern. Bulkheads are also placed at the forward end of each of the well-hole pontoons, against which the fore-and-aft bulkheads on each side of the well hole terminate. The supports for the bow gantry are solid steel-plate bulkheads inside the hull, one on each side of the well hole. They are made up of plating  $\frac{3}{8}$  in. thick and  $6 \times 6 \times \frac{1}{2}$ -in. angles, extending from the outer walls of the hull across to the well-hole walls and between the bottom and the back end of the well hole. The structures extend from the floor of the hull up under the bow gantry footings. There are four of these footings, built on the deck, two on each side of the well hole.

The main housing extends from the stern to a point about 40 ft. aft of the bow and the full width of the dredge. The winch room is situated on the forward end of the main housing on the starboard side of the dredge. The screen housing extends from the main hopper to the stern. The housing also covers the upper main-drive pulley belt. The general arrangement of these structures is similar to the housing arrangement of Yuba No. 13 dredge, the largest wooden-hull dredge in California and the last one built in this district.

The vertical frames of all the housings are built of 5-in. 6.5-lb. channels placed about 32 in. apart. The beams on the main screen house are 8-in. 11.25-lb. channels. These beams are attached to every vertical frame. A stringer channel of the same size is attached to the vertical frames and to the beams, tying these members together. The beams supporting the roof of the winch room are 5-in. 6.5-lb. channels. The floor of the winch room is laid with  $1\frac{1}{4} \times 4$ -in. tongue-and-groove Oregon pine. The floor rests on 12-in. 20.5-lb. channels. The vertical sheathing of the housings is composed of two sheets of No. 22-gage steel plates with  $\frac{1}{4}$ -in. paper mill-board between them, which serves as a heat insulator. The sheathing is attached to the vertical frames by steel battens  $\frac{1}{8} \times 3\frac{1}{2}$  in. The battens also form seam straps between the sections of the sheathing. All the roofing is built of  $1\frac{1}{4} \times 4$ -in. tongue-and-groove Oregon pine nailed to  $2 \times 4$ -in. Oregon pine strips bolted to the rafters. The roof is covered with canvas which is painted and thus made water-tight. The inside of the roofing is fireproofed by the use of  $\frac{3}{16}$ -in. paper mill-board. The housing is painted tan gray.

The ladders and platforms are made of steel. Steel platforms are built about the gold-saving tables, extending along the inside of the housing to the stern of the dredge and across the stern to the screen drive and stacker, with checkered tread plates  $\frac{3}{16}$  in. thick.

Two derricks employed for handling and placing material were set up at the edge of the pit, 77 ft. apart. One was of 20-ton capacity, mast 105 ft. high, boom 98 ft. long. One was 15-ton capacity, mast 86 ft. high, boom 80 ft. long.

(To be continued)

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### Liability for Injury to Miner

BY A. L. STREET\*

The responsibility of an Alaska mining company for injury to a miner while he was being hoisted from work in a shaft 45 ft. deep, under direction of his foreman, caused by his being crushed between the top of the ve-

hicle on which he was riding and an overhead beam, was involved in the case of Johansen vs. Pioneer Mining Co., 137 Pacific Reporter 1019, which was recently before the Washington Supreme Court. In affirming judgment in plaintiff's favor, the court held that the jury were warranted in finding that the foreman had been habitually so negligent that the company was careless toward plaintiff in retaining the foreman at the time of the accident. The evidence was also declared to be sufficient to warrant a finding that the signal wire used in moving the vehicle was so defective as to be unsafe. The court further holds that, although, where there are two methods whereby a workman may do a thing, one perilous and the other safe, he assumes the risk of adopting the unsafe way, plaintiff was not negligent in leaving the shaft on top of the vehicle, as directed by his foreman, although he might have safely left the place by using a ladder which was provided; he not being apprised of any danger in using the elevator. The Supreme Court adds that an employee, in leaving his place of work, is entitled to the same protection from injury while still on the employer's premises that he is entitled to while at work. A verdict for \$18,000 in favor of plaintiff is declared not to have been excessive, in view of the fact that he was severely crushed in the accident, was only 29 years old and had previously earned \$4 a day.

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### Financial Statistics of the Rand

BY A. COOPER KEY\*

The Union Mines Department has now issued as an appendix to the usual monthly statistics for August, a statement of capital embarked in mining enterprise in the union of South Africa, as of Dec. 31, 1912, which was omitted from the annual report of the government mining engineer, so as not to delay that publication. In the Transvaal, returns were filed by 203 gold mines. They had a nominal capital of £76,060,712, of which £5,498,219 was in reserve, leaving £70,562,493 actually in issue. This figure is split up into two specifications, the sum of £49,784,475 being for property equipment, shafts, mine development, and the assets, and £20,778,463 for cash. Since the inception of the companies, £12,976,463 of debentures have been issued, but considerable sums have been redeemed and the net amount outstanding is given at £8,689,810. Besides debentures, there were temporary advances amounting to £2,641,684. Altogether the companies received £19,663,905 in premiums on shares, but no less than £11,492,696 has been written off, leaving a net amount of £8,171,209.

On the Rand itself, returns were received from 115 companies, of which 41 are dividend-paying, 21 producing but not dividend-paying, nine developing, and no less than 44 dormant. The net issued capital was £60,788,200, of which about £42,500,000 represented property, equipment shafts, etc., and the balance was for cash. Sir Lionel Phillips, in a recent speech, declared that, "On the whole, the amount that was paid in dividends was, if anything, on the poor side from the standpoint of a return for the amount invested." Last year's aggregate was just under eight millions. If we add the net amount of premiums on shares, the relative capital appears to be about £68,500,000, and the distribution would represent 11.7%, if it be reckoned on the net issued capital irre-

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spective of premiums, it would be just over 13%. Allowance must be made on both rates for amortization of capital before the true interest yield to the original investor is determinable, the yield would, of course, be far less to the purchaser of shares in the market at prices considerably in advance of the face value of the shares. Outstanding debentures on Rand mines come to about 8½ millions and temporary advances to rather under 2¼ millions. In the 25 years of its existence, the Rand has paid some £88,000,000 in dividends and something like 20 million more than the amount of capital as above shown without allowing anything for interest during that lengthy period.

The balance sheet of the Rand shows a total on the debit side of £102,720,000. Against this it has the following main assets:

Mining property .....	£38,750,000
Shafts and mine development.....	17,700,000
Equipment .....	29,700,000
Investments .....	1,870,000
Produce on transit .....	2,200,000
Cash .....	8,100,000

Sundry debtors, stores, undistributed balances, each represent a million, while there is a deficiency of assets amounting to £1,175,000.

With the exception of the Barberton Pilgrims Rest district, the showings of the outside districts are lamentable; even here they are not good, the dividends last year amounting to less than £300,000 on an issued capital of £4,400,000. Only five mines out of 50 are in the dividend-paying class. In the Heidelberg district mines, shareholders received but £44,000 on an issued capital of £2,660,000. Not one of the 20 mines in the Klerksdorp district was dividend-paying, only five were working. This district has embarked in it much the same amount of capital as Heidelberg.

Owing to the self-denying policy of the shareholders of the Premier company, in putting back profits into the mine and devoting them to equipment, the capital account has been kept low. Including all the failures of the Pretoria district, as well as that outstanding success of mining enterprise in the Transvaal since the war, the net issued capital of the Transvaal Diamond mines, is but £375,000, the dividend last year being £360,000, the whole contributed by the company named.

Coal mines in the Transvaal have of late years done much better from a dividend point of view, their total distributions being £303,000 in respect of £3,900,000, according to the return. This is, however, illusory, the figure of £135,650 being given for the Springs or Brakpan, which are now nearing exhaustion. An error is caused by the inclusion of the Transvaal Coal Trust which, though it paid £109,150 in dividends, derived no less than £101,400 from its dividend on a quarter of a million shares in the Brakpan gold mines. The figure given compares with £158,000 for the Middleburg district (capital £2,308,000) and the fact that the output of the Middleburg district is 10 times as great as that of the Springs or Brakpan is, and would, one would have thought, have put the compiler of statistics on his guard. The true dividend aggregate from coal winnings is probably about £200,000.

Of £1,654,000, the net issued capital of base-metal mines in the Transvaal, tin represents £1,287,000 and these mines are the only dividend payers at present, the distribution being £100,500. Diamond mines of the Cape Province paid £2,300,000 on an issued capital of £5,920,000, and those of the Orange Free State, £358,500 on

£2,740,000. Base mineral concerns of the Cape (principally the copper mines of Namaqualand) paid £123,000 in dividends against a capital of £1,322,000, the Natal coal mines £72,000, their issued capital being £1,102,000. Viewed as a whole, the figures clearly demonstrate the overwhelming importance of the Rand gold mining industry and the diamond mines of Kimberley and Pretoria.

### The Exploration Co. in Mexico

The remarks of R. T. Bayliss, chairman of the Exploration Co., respecting the operations of that important company in Mexico, which he made at its recent stockholders' meeting, are of interest. He said:

Dealing now with our interests in Mexico, the Exploration Co., of England and Mexico, through which company our search for and development of mining properties in the republic is carried on, was compelled to suspend operations in January, 1913. Under the conditions then prevailing, which have since been aggravated by the complete demoralization of the railways, it was useless to spend further money in the examination or acquisition of mines, with which it would be impossible to do anything until order is restored. The El Oro Co. has, fortunately, been able to continue working without serious physical interference. That is the most I can say, for its operations have been conducted under circumstances of exceptional difficulty, and at times the impossibility of obtaining adequate supplies has brought it within measurable distance of closing down. The future of this property is, however, particularly encouraging, for the recent purchase of an adjoining property, which developed in a truly remarkable manner, has added materially to the prospective life of the El Oro mine. In view, however, of the difficulties with which the company was surrounded, and having regard to the unstable conditions in Mexico, the directors of the El Oro Co. decided, in December last, prudently, as we think, to suspend the payment of dividends.

The Buena Tierra mine, in Chihuahua, has been in the very storm center of the conflict in the northern part of the republic. Beyond the stoppage of production from the mine, and the loss of revenue from our holding of more than one-half of the shares of the company, the situation there does not cause us any anxiety; for the Buena Tierra mine is not in a vulnerable position. As it sells all its product to the A. S. & R. Co., it has not any large reduction works which might suffer from wanton destruction; and as the mine itself is absolutely free from water and cannot otherwise be injured, the company is not likely to sustain any material loss. During the past year this mine has only been able to work intermittently, and on the 1st of November last the A. S. & R. Co. shut down. I am pleased to be able to state, however, that a message recently received from this mine stated that the A. S. & R. Co. resumed operations on Feb. 1, 1914, and in due course we shall, therefore, be able to commence the shipment of ore to the smelter from the Buena Tierra mine. I should like to add, for the information of the many shareholders of this company who are also shareholders of Buena Tierra, that, notwithstanding all the troubles that have beset that company, the mine is all right, and will justify every statement I have made concerning it when it is allowed an opportunity to do so.

The Santa Rosa mine, situated in Zacatecas, is, however, in a more serious plight. Owing to the destruction of the railway serving the property, we had to close down all construction work in April last. We were able to carry forward development work up to December, but since that date the entire staff has been withdrawn, and the property is now in the hands of caretakers, and, happily, so far uninjured. The interruption of work on this property has been very aggravating. As I informed you last year, when the mill first commenced operations we had to contend with certain metallurgical difficulties. A further series of experiments, on a practical scale, proved that these could be overcome by a comparatively inexpensive rearrangement of the plant, and we had, therefore, every reason to expect that by the 1st of June last year the improved mill would be in operation and the company earning substantial profits. The development has been most satisfactory; in fact, it is proving a much larger mine than we anticipated; and personally I have little doubt that when we are able to work without interruption it will prove a very productive property. For the time being, however, the delay is a serious matter for us, as we have put upward of £70,000 into this property in one way and another, and until peace is restored we shall be unable to get it back.



# Effect of Pressure on Chemical Reactions

By H. C. JONES\*

*SYNOPSIS*—Methods of altering equilibrium points and velocity of chemical reactions. Effects of pressure and temperature changes. Effects of moisture on chemical reactions.

In the last paper, we have gained some idea of the effect of temperature on the velocity and equilibrium of chemical reactions. We have seen that the velocity of some reactions may be changed many thousand times, by simply changing the temperature to which the reacting substances are subjected. We have seen, further, that the equilibrium point may be moved in the one or in the other direction, by simply varying the temperature to which the substances in equilibrium are subjected.

We shall now take up the effect of pressure on both the velocity and equilibrium of chemical reactions. The effect of pressure on the velocity of chemical reactions can be dealt with fairly satisfactorily. Results of great interest and importance have been obtained from the study of the effect of pressure on the velocities of chemical reactions. Since the nature of the results obtained depended on what is called the order of the reaction, we must discuss just what is meant by the order of a chemical reaction. We have chemical reactions taking place in which the mass or quantity of only one substance undergoes change. Take the inversion of cane sugar by water in the presence of an acid or, as we say, of hydrogen ions. The cane sugar is inverted into dextrose and fructose and as such is used up. The active mass of the sugar undergoes change, the sugar as such gradually disappears as the reaction proceeds.

Since, for every molecule of sugar inverted, one molecule of water is used up, it might be thought that the active mass of the water also was undergoing change as the reaction proceeds. We always study such inversion in aqueous solution and usually in fairly dilute solution. Even in the most concentrated solution of cane sugar that can be prepared, there are a very large number of molecules of water present to every molecule of cane sugar. There is so much water present, that the amount used up in the reaction is negligible, as compared with the total amount of the water. The active mass of the water, as we say, does not undergo any appreciable change. Reactions of this type, where the active mass of only one substance undergoes change, are known as first-order reactions.

We calculate the velocity of first-order reactions in the following manner. If we represent the initial amount of substance used by  $S$ , and the amount of it  $x$ , transformed in time  $t$ , the velocity of the reaction is expressed thus:

$$\frac{dx}{dt} = C(S - x)$$

The constant  $C$  is the so called velocity coefficient of the

reaction. Let us now integrate the above expression when we have:

$$-ln(S - x) = Ct + \text{const.} \quad (1)$$

When the reaction starts the time  $t$  is zero, and the amount transformed,  $x$ , is zero, when the above expression becomes:

$$-ln S = \text{const.} \quad (2)$$

Substituting (2) in (1),

we have  $-ln(S - x) + ln S = Ct$ , from which  $C = \frac{1}{t} ln \frac{S}{S-x}$ . This is the equation for calculating the

velocity coefficient or velocity constant of a first order reaction. There are many first order reactions, and some of these are among the most important reactions known to the chemist. Many catalytic reactions are of the first order, and catalysis is coming to play a more and more important rôle not only in scientific, but in industrial chemistry. Take the so called contact method of producing sulphuric acid. The platinum acts as a catalyzer, causing the oxygen to combine with the sulphur dioxide and form sulphur trioxide. Take the "fixation" of nitrogen by causing it to combine directly with hydrogen and form ammonia. This takes place to an appreciable extent only in the presence of some catalyzer.

The point in the present connection is, that first-order reactions are practically independent of pressure. It has been shown by Rothmund<sup>1</sup>, that the velocity with which cane sugar is inverted in the presence of hydrochloric acid is practically independent of the pressure to which the reacting substances are subjected. This will be seen from the following data. For a pressure of 250 atmospheres and a temperature of 160°, the constant multiplied by 10<sup>6</sup> = 1684. The constant for the same conditions except using a pressure of one atmosphere, was 1702. In another series of experiments using a pressure of 500 atmospheres, the constant was 1362, while under a pressure of one atmosphere, the constant is 1418.

From these results, it is obvious that with increase in the pressure to which the reaction is subjected, the velocity of the reaction decreases about 1% for every increase in pressure of 100 atmospheres. While pressure decreases the velocity with which cane sugar is inverted, it works in exactly the opposite way with certain other reactions. Take, for example, the hydrolysis of methylacetate, as effected in the presence of a normal solution of hydrochloric acid. The hydrolysis of the ester takes place about one-fifth faster under a pressure of 500 atmospheres than under a pressure of one atmosphere. The hydrolysis of methyl acetate in the presence of acetic acid gave results of the same general character.

The effect of pressure on the velocity of reactions in which gases are formed, will be discussed later, when we come to study the effect of pressure on chemical equilibrium. Let us see what the effect of pressure on second-order reactions is. A second-order reaction is one in

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Note—This is the last of the new series of papers by Dr. Jones. Preceding articles of this series appeared in the issues of Mar. 14 and 21, 1914.

<sup>1</sup>"Zeit. für phys. Chem.," 20, 172 (1896).

which the active masses of two things undergo change. Take the saponification of an ester by a base, e.g., methyl formate saponified by potassium hydroxide. The reaction is  $\text{HCOOCH}_3 + \text{KOH} = \text{HCOOK} + \text{CH}_3\text{OH}$ . In this reaction both the ester and the base are used up, and the reaction is, therefore, of the second order. The velocity of such a reaction is calculated thus: Let us represent the initial substances by  $S$  and  $S_1$ , and the amount transformed in time  $t$  by  $x$ . The velocity of such a reaction is expressed by the following equation:

$$\frac{dx}{dt} = C(S - x)(S_1 - x)$$

If we take the two substances in question in equivalent quantities,  $S_1 = S$ , and the above equation becomes

$$\frac{dx}{dt} = C(S - x)^2$$

Integrating this equation, we have:

$$\frac{1}{S - x} = Ct + \text{const.}$$

When the reaction first starts  $x = 0$ , and  $t = 0$ , when the last expression becomes  $\frac{1}{S} = \text{const.}$

$$\frac{1}{S - x} - \frac{1}{S} = Ct$$

$$C = \frac{1}{t} \frac{x}{S(S - x)}$$

or

$$CS = \frac{1}{t} \frac{x}{S - x}$$

which is the equation used for calculating the velocity coefficient of a second-order reaction.

What is the effect of pressure on the velocity of a second-order reaction? The work of Bodenstein<sup>1</sup> on the decomposition of hydriodic acid by heat, shows that pressure has a marked effect on the velocity of second-order reactions. The velocity increased very nearly proportional to the pressure to which the gas was subjected.

Van't Hoff concluded that the velocities of second-order reactions are proportional to the pressures to which they are subjected. When three substances take part in a reaction, or, as we say, the active masses of three things undergo change, we have what we call a third-order reaction. What is the effect of pressure on the velocities of third-order reactions? The velocity of a third-order reaction is calculated as follows: Let  $S$ ,  $S_1$  and  $S_2$  be the amounts of the three substances with which we start, and let  $x$  of each be transformed in time  $t$ . The velocity of the reaction is:

$$\frac{dx}{dt} = C(S - x)(S_1 - x)(S_2 - x)$$

If we take the three substances in equivalent quantities, i.e., let  $S = S_1 = S_2$ , the above becomes:

$$\frac{dx}{dt} = C(S - x)^3$$

which, when integrated and letting  $t = 0$ ,  $x = 0$ , we have,

$$C = \frac{1}{t} \frac{x(2S - x)}{2S^2(S - x)^2}$$

For reactions of this class, the velocity is very greatly

affected by pressure. Indeed, the velocity varies not simply proportional to the pressure, but to the pressure squared. So much for the effect of pressure on the velocities of reactions that take place in the liquid state and in solution. Let us now see what is the effect of pressure on the velocities of reactions that take place between gases.

#### EFFECT OF PRESSURE ON REACTIONS INVOLVING GASES

The effect of pressure is to diminish volume. Whatever takes place with increase in volume we would expect to be diminished by subjecting it to high pressure. Take a reaction in which a gas is formed. This would take place with increase in volume. We should, therefore, expect pressure to diminish the velocity of such a reaction. One of the first to observe the effect of pressure on a reaction in which gases were involved, was Beketoff<sup>1</sup>. He showed that hydrogen gas under pressure will precipitate metallic silver from a solution of silver sulphate, and metallic platinum from a solution of platinum chloride. The separation of silver was found to begin when the hydrogen reached a pressure of about six atmospheres.

It was first noted by Cailletet<sup>2</sup>, that the production of hydrogen by the action of metals on an acid, can apparently be stopped by subjecting the reacting substances to high pressures.

The quantitative study of this problem we owe to Tamman and Nernst<sup>3</sup>. They measured the maximum pressure under which hydrogen gas will be set free by the action of acids on metals. Take the action of sulphuric acid on metallic zinc, the pressures that were just necessary to cause the evolution of hydrogen gas to cease for the different concentrations of the sulphuric acid used, are given in the following table. The concentrations of the sulphuric acid employed in gram-equivalents per liter are given under  $C$ ; the concentrations of the zinc sulphate under  $C_1$ ; and the pressures of the hydrogen in atmospheres under  $P$ .

	C	C <sub>1</sub>	P
1	0.13 H <sub>2</sub> SO <sub>4</sub>	1.3 ZnSO <sub>4</sub>	18.0 Atmospheres
2	0.11 H <sub>2</sub> SO <sub>4</sub>	1.2 ZnSO <sub>4</sub>	23.5 Atmospheres
3	0.29 H <sub>2</sub> SO <sub>4</sub>	0.7 ZnSO <sub>4</sub>	25.6 Atmospheres
4	0.20 H <sub>2</sub> SO <sub>4</sub>	0.36 ZnSO <sub>4</sub>	57.0 Atmospheres
5	0.35 H <sub>2</sub> SO <sub>4</sub>	1.15 ZnSO <sub>4</sub>	29.0 Atmospheres
6	0.34 H <sub>2</sub> SO <sub>4</sub>	1.16 ZnSO <sub>4</sub>	40.2 Atmospheres

The following results were obtained with zinc and hydrochloric acid:

C	C <sub>1</sub>	P
0.68 HCl	0.30 ZnCl <sub>2</sub> + 1 ZnSO <sub>4</sub>	48 Atm.
0.68 HCl	0.30 ZnCl <sub>2</sub> + 1 ZnSO <sub>4</sub>	52 Atm.

When cadmium and hydrochloric acid were used, the hydrochloric acid having the concentration 0.62 normal and the cadmium chloride present being 0.3 normal, a pressure of about 44 atmospheres was required to prevent further evolution of the hydrogen gas. With iron and sulphuric acid of concentration 0.46, the pressure that was necessary and just sufficient to prevent further evolution of hydrogen is given at 6.4 atmospheres. When normal sulphuric acid was used, the pressure necessary to prevent further evolution of hydrogen was somewhat greater than 34 atmospheres; while when twice normal sulphuric acid was employed, the equilibrium pressure was above 90 atmospheres. The pressure necessary to prevent further evolution of hydrogen in the case of manganese and normal hydrochloric acid is 52 atmospheres.

<sup>1</sup>"Compte Rendus," 48, 442 (1859).

<sup>2</sup>"Compte Rendus," 68, 395 (1869).

<sup>3</sup>"Zeit. für phys. Chem.," 9, 1 (1892).

<sup>1</sup>"Zeit. für phys. Chem.," 13, 56 (1894).



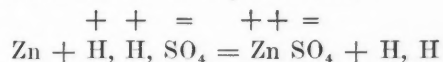
In the case of nickel with sulphuric and hydrochloric acids, the following results were obtained:

C	C <sub>1</sub>	P
0.94 H <sub>2</sub> SO <sub>4</sub>	0.07 ZnSO <sub>4</sub>	7.5 Atmospheres
1.52 H <sub>2</sub> SO <sub>4</sub>	0.50 ZnSO <sub>4</sub>	42.0 Atmospheres
0.86 HCl	0.15 ZnCl <sub>2</sub>	23.1 Atmospheres
0.88 HCl	0.15 ZnCl <sub>2</sub>	29.0 Atmospheres

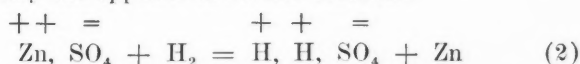
The equilibrium in the case of one-fourth normal sulphuric or hydrochloric acid with magnesium, was somewhere above 95 atmospheres.

The equilibrium in the case of a 1% sodium amalgam and 10 normal sodium hydroxide, is above 90 atmospheres.

These cases have been discussed at some length and in some detail because of their inherent interest and importance. The question arises here, is it simply the pressure of the hydrogen gas, which apparently stops the reaction in question? If it is, then the presence of any other gas than hydrogen at the same pressure would prevent the further liberation of hydrogen by the action of the metal in question on the acid in question at the given concentration. Such, however, is not the fact. An equal pressure of any gas other than hydrogen will not entirely stop the evolution of the hydrogen. What does this mean? I think the explanation is simple. We have here a reversible reaction, zinc acting in sulphuric acid liberating hydrogen and forming zinc sulphate. This is the reaction that we usually write thus:



the plus and minus signs mean that the substances are present in the ionic conditions. We have going on simultaneously the opposite or reverse reaction:



Equilibrium is established, or there seems to be no further evolution of hydrogen when these two opposite reactions acquire the same velocity; when, in any given time, just as much hydrogen enters into combination as is set free. The influence of pressure is, then, to prevent the gas from being liberated; and when the pressure is produced by hydrogen, the velocity of the counter reaction (2) is increased, and both of these processes react against the initial reaction. It would, therefore, require a greater pressure of some gas other than hydrogen, to prevent the liberation of hydrogen from acids by metals, and such is the fact.

Before leaving the general subject of the effect of pressure on the velocities of chemical reactions, especially in solution, we should discuss the effect of pressure on the conductivity of aqueous solutions of electrolytes. It was noted by Fanjung, working with Arrhenius, that pressure increases the conductivity of aqueous solutions of electrolytes. A pressure of 500 atmospheres increases the conductivity about 8%. The question is, to what is this increase in conductivity due? Does pressure increase the dissociation of the electrolyte, or does it increase the velocity with which the ions move? This is an important matter, now that we know that chemical activity depends for its existence upon charged parts or ions.

Fanjung furnished the answer to this question in a convincing way. He took a solution of an electrolyte, which at ordinary pressure was completely dissociated. He subjected this to high pressure and found that the conductivity increased just as rapidly with pressure, in

this case, as with only partially dissociated solutions. This showed that the effect of increase in pressure was not to increase the dissociation of the solution, since the dissociation was already complete at the lower pressure. The other factor determining conductivity is the velocity with which the ions move. Anything which increases the velocity of the ions increases the conductivity. The effect of pressure as increasing the conductivity of aqueous solutions of electrolytes is then, to increase the velocities with which the ions move. Chemical activity depends upon the ions of the reacting substances coming together. It, therefore, depends upon the numbers of the ions present and the velocities with which they move. The effect of pressure on aqueous solutions, when it increases the velocities of the reactions, is to increase the velocities of the ions in the solutions which are reacting. This effect, however, is not large enough to account for all the influence which has been observed, of pressure on reaction velocities.

#### EFFECT OF PRESSURE ON CHEMICAL EQUILIBRIUM

It was comparatively early observed that the effect of pressure on a system in equilibrium is to shove the equilibrium in the direction in which more of the system is formed, which is produced with a diminution in volume. If the pressure is removed, the equilibrium will be moved in the direction to produce more of the substance which is formed with increase in volume.

Le Chatelier, in his "Les Equilibres Chimiques," formulated the effect of pressure on chemical equilibrium about as stated above, pointing out that if there is no appreciable change in volume when one of the two systems in equilibrium passes over into the other, pressure would have practically no influence on the equilibrium. The effect of pressure and also of temperature on the equilibrium of chemical reactions, has been worked out mathematically by M. Planck<sup>1</sup>. It would lead us beyond the scope of these papers to discuss this work in any detail.

#### COMBINED EFFECT OF TEMPERATURE AND PRESSURE

We have seen what effect temperature alone has on chemical equilibrium. Rise in temperature in general opposes reactions which take place with evolution of heat—exothermic reactions, and favors reactions which take place with absorption of heat—endothermic reactions.

We have likewise studied the effect of pressure on chemical equilibrium. Increase in pressure in general favors the formation of those substances which are formed with diminution in volume, and opposes the formation of those things whose formation involves an increase in volume. Increase in pressure, especially opposes those reactions in which a gas is produced. The formulation of the effect of temperature and pressure on chemical equilibrium we owe to Le Chatelier. His law is: "Any change in one of the factors which determines the equilibrium, will produce a change in the system such that this factor suffers the reverse change." Thus, pressure favors reactions which take place with loss in volume, as when two gases combine to form a solid, say hydrochloric acid and ammonia combine to form ammonium chloride. Pressure opposes reactions in which a gas is formed, as in the action of acids on metals; and pressure has no effect on

<sup>1</sup>Wiedmann's Annalen, Vol. 32, p. 495 (1887).

reactions taking place without change in volume, as the action of hydrogen and chloride forming hydrochloric-acid gas.

This principle which included all cases of chemical equilibrium, and which is, therefore, of fundamental importance, is known as the law of Chatelier.

#### EFFECT OF TEMPERATURE ON THE EXOTHERMIC OR ENDOTHERMIC NATURE OF REACTIONS

It would be gathered from what has thus far been stated, that a reaction once exothermic or once endothermic, would remain so under all sets of conditions. Such is not the case. A given reaction may, at one temperature, be exothermic; and at a different temperature the same reaction may become endothermic. The work of Bodenstein<sup>1</sup>, on the decomposition of hydriodic acid, illustrates this point very well. When hydriodic acid is formed at 18°, there are 6100 cal. of heat absorbed, the reaction is very endothermic. When the acid is formed at 186°, there are only 440 cal. of heat absorbed. Rise in temperature increases the amount of the acid formed, up to 320°, showing that the reaction remains endothermic up to this temperature.

Above 320° rise in temperature diminishes the amount of hydriodic acid formed, showing that above this temperature the reaction involving the formation of hydriodic acid has become exothermic. There we have a reaction becoming less and less endothermic as the temperature is raised, and finally becoming exothermic above 320°.

This change in the thermic character of a reaction with change in temperature often renders a substance stable over certain ranges in temperature, and unstable over intermediate ranges. Thus, ozone is stable below 200°, but at 300° is practically all converted back into oxygen. Above 1000°, it is unstable, but is stable on both sides of these temperatures.

#### EFFECT OF MOISTURE ON THE VELOCITIES OF REACTIONS

We have seen in this chapter what are the general effects of temperature and pressure on the velocities of chemical reactions. There is one other condition which must be discussed in this connection, since its bearing on scientific and industrial questions is of the same order of importance as temperature and pressure; this is the effect of moisture.

The importance of the effect of moisture on chemical reactions has acquired a new interest, since the theory of electrolytic dissociation was proposed and since we have recognized that ions are essential to all chemical activity. A large number of examples are available, illustrating the effect of the minutest traces of moisture on chemical reactions. Only a few of these will be considered here, those chosen being among the more striking.

When every trace of moisture is removed from an acid, the substance loses all of its acid properties. Take hydrochloric-acid gas and dry it with the greatest thoroughness over phosphorus pentoxide. Then conduct it into benzene or chloroform, which has been dried with the same care as the acid gas. These solvents are chosen since they have practically no dissociating power. The benzene or chloroform solution of hydrochloric acid has no trace of acid properties. When the solution of the gas is poured

on a metal such as zinc, nothing takes place. The zinc is not dissolved nor is hydrogen evolved when the substances have been properly dried. Further, such a solution of hydrochloric acid will not precipitate a solution of silver nitrate in ether or benzene which has been dried with sufficient care.

The above solution of the hydrochloric-acid gas will not even color blue litmus red. We have had in my laboratory solutions of hydrochloric-acid gas in benzene which would not color blue litmus red. Again, such a solution of hydrochloric acid would not decompose carbonates, provided the carbonates had been dried with sufficient care. This is obviously a remarkable fact, that molecules of hydrochloric acid could be brought into contact with molecules of a carbonate, and not decompose the salt of such a weak acid as carbonic.

Sulphuric acid can also be dried until it loses all of its acid properties, until it will not color blue litmus red, and will not decompose carbonates. Enough has been done to show that no substance in the pure, homogeneous condition is an acid, and the same applies to bases. No substance in the pure homogeneous condition is a base. The one becomes an acid and the other a base, only when they are brought into the presence of something which will dissociate them, only when they become ionized.

Another reaction perhaps even more striking than the above, is that of ammonia gas and hydrochloric-acid gas. When these two gases are dry, there is no trace of reaction between them when they are brought together. This was shown by Baker in England.

Most remarkable of all, however, is the case of sulphuric acid and metallic sodium. When the proper precautions have been taken to dry both of these substances, there is not the slightest reaction when the sodium is plunged beneath the sulphuric acid. There is at first a slight reaction, then the sodium remains suspended in the sulphuric acid in a quiescent condition as it would in ligroin. If anyone desires to carry out this experiment, let him first learn how really to dry things. The ordinary methods of drying are of no avail, and if the experiment is performed with insufficient drying, the results may lead to regret on the part of the experimenter. These results suffice to show the importance of moisture, even in minute quantities, as conditioning chemical reactions. We, of course, know the meaning of these important facts, important industrially as well as scientifically. The water present affects incipient ionization, and the ions are essential for chemical action.

If molecules could react chemically, then the conditions described below would be more favorable for chemical action, and the facts are, we do not get a trace of chemical activity. Pure, dry, liquid hydrochloric acid does not have a trace of acid properties, yet here the molecules are the most concentrated. We often, in industrial chemistry, want to exclude a certain chemical action. This might, in some cases, be accomplished by excluding all traces of moisture. The above illustrations are sufficient to show what can be accomplished by excluding moisture from the presence of things which otherwise react most vigorously.

In discussing the effect of pressure on chemical reactions, the recent work of Cohen should be consulted. He has published about a dozen papers on this subject in the last few years in the *Zeitschrift für physikalische Chemie*.

<sup>1</sup>"Zelt. für phys. Chem.," Vol. 13, p. 156 (1894).



# Mine Safety in Southeastern Alaska

BY FREDERICK L. HOFFMAN\*

*SYNOPSIS—Mining principal industry of Alaska; inadequate inspection. Treadwell group most important in the territory. Data on nationality of employees, wages, living conditions, safety precautions, death rate, causes of fatalities and compensation prescribed by recently formed committee of safety.*

✽

The mining industry of Alaska is of the first order of importance to that territory. According to the thirteenth census, out of a total male population of only 39,598, aged 15 years and over, 8025 persons, or 20.3%, were engaged or employed in the mining industry. The capital invested in this industry was \$47,749,000, and the total amount paid during the census year in salaries and wages was \$6,819,000. In marked contrast, there were only 222 farms, of a total value, including all farm property, of \$1,468,000. There were also only 152 manufacturing establishments, with an invested capital of \$13,000,000, employing 3479 persons on salaries or wages, who earned \$2,328,000 for services during the census year. In 1913, according to the U. S. Geological Survey, there were 466 miles of railway in the territory, covered by nine different systems, from 5 to 195 miles in length, but only 260 miles were operated; such transportation facilities are totally inadequate for a territory with a land area of 590,884 square miles. The mining industry is widely distributed throughout the whole of Alaska, and mining operations outside of southeastern Alaska are carried on under climatic conditions fundamentally more or less different from those of the United States.

## SYSTEM OF TERRITORIAL INSPECTION

On Apr. 19, 1911, under authority of Congress, the President appointed a mine inspector for the Territory of Alaska, to serve under the direction of the Bureau of Mines. The first report of this inspector, Sumner S. Smith, is an interesting document, reflecting the enormous difficulties of adequate government supervision of the mining industry in a territory of such vast extent and practically unprovided with modern traveling facilities. The office of the inspector is at Juneau, which is far removed from such important districts as Nome and Fairbanks. An apt illustration of the difficulties confronting the inspector is a shaft accident which occurred in the Fairbanks district in October, 1911, and in which as the result of a cave 13 men were imprisoned, fortunately with no fatal results. It would have required at least three weeks for the inspector, then in Ketchikan, to reach the Fairbanks district, by which time, of course, the causes responsible for the accident would have been largely obscured. Considering the magnitude of Alaska's mining industry and its predominating importance to the people of that district, it is self-evident that for the adequate discharge of his important duties the inspector should be provided with a larger staff than he has at present.

Labor conditions are briefly referred to in the annual report of the inspector for 1912, it being stated that the scale of wages varied from \$3.50 per day for miners along

the southeastern coast to \$5 and board in the Fairbanks district. In Nome \$5 and board was standard for summer and \$3 to \$4 and board for winter. The hours varied from 8 to 12, with a 10-hr. shift predominating. During the year it was estimated that there were 5000 men at work underground in the territory. There were 12 fatal accidents reported to the inspector, but there are strong reasons for believing that this is an under-estimate of the truth, largely because of the inadequate facilities for thorough inspectorial and supervisory work.

## THE TREADWELL GROUP

At the present time the most important mining in Alaska is carried on at the Treadwell group at Douglas, near Juneau. For this group of mines a considerable amount of information is available through the official reports of the company and the occasional references thereto in the official publications of the Government. The subject of mine hazards seems not to have attracted much attention in Alaska until of recent years, for there are practically no useful references thereto in the annual reports of the governors for the last 20 years.

It is regrettable that there should not be complete labor statistics for the Treadwell group of mines, since entirely trustworthy accident rates cannot be calculated upon the information at present available. For practical purposes, the average number of men employed constitutes the most useful basis for the calculation of accident rates and the most convenient method for obtaining a true average is either to add the number of men at work, say, on the first day of each month throughout the year and divide the result by 12, or better still, to obtain the number of men at work for each working day of the year and divide the total by the actual number of days worked. The average thus obtained is a trustworthy basis for calculating the true risk exposure, without more precise, but naturally much more elaborate actuarial methods.

## NATIONALITY OF THE EMPLOYEES

Through the courtesy of the company I have been furnished, however, with a most interesting return of all men employed in the Treadwell group of mines on Dec. 31, for the three years, 1910, 1911 and 1912. The information is given in detail in Table I, together with the nationality and the percentage distribution, which shows rather suggestive variations from year to year, with an unusual tendency toward a larger proportion of American labor and a diminution in the proportion of mine labor from the southeastern countries of Europe.

## WAGES AND LIVING CONDITIONS

While it is probable that the number employed varied more or less throughout each year, it is fairly safe to accept the numbers given as approximately the average labor force, upon the basis of which an accident rate can be calculated with at least approximate accuracy. It is regrettable that corresponding information should not be available for the entire group of Treadwell mines by occupations. It may be said in this connection that the wages paid to others than foremen range from a minimum of \$3 for laborers to \$6 for assistant foremen. In

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

the mills some of the men are paid on a monthly basis, ranging from a minimum of \$95 for vannermen and oilers, to a maximum of \$180 for foremen. Employees who board at the company's boarding houses are charged \$25 per month for meals and \$2 per month is added for occupancy of a room in one of the company's lodging houses. All of the employees are charged \$1.50 per month for hospital dues, and all employees, with the exception of natives and Japanese are charged \$1 per month for club dues. On Dec. 31, 1912, there were 250 men boarding at the Treadwell boarding house and 200 men at the Mexican boarding house, the number in both cases being less than for the previous year. So far as it is possible to judge, the changes in the labor supply are large, but not much more so than for some of the long-settled mining districts of the United States and Europe. The company has made a careful study of the permanency of the labor force by nativities and past experience seems to justify the conclusion that on the whole the American element is from every point of view the most satisfactory.

TABLE I—NATIONALITY REPORT OF ALL MEN ON THE TREADWELL, MEXICAN AND READY BULLION PAY-ROLLS ON DEC. 31, OF THREE YEARS

	1910		1911		1912	
	No.	%	No.	%	No.	%
Americans	223	15.9	347	20.3	240	18.8
Austrians	238	17.0	282	16.5	218	17.5
Belgians	46	3.3	68	3.9	45	3.5
Bohemians	...	...	1	0.1	...	...
Canadians	22	1.6	24	1.4	10	1.0
Danes	3	0.2	2	0.1	3	0.2
English	45	3.2	49	2.9	44	3.5
Finnns	44	3.1	95	5.6	72	5.7
French	8	0.6	6	0.3	3	0.2
Germans	33	2.4	59	3.4	26	2.0
Greeks	30	2.1	72	4.2	54	4.2
Hindoos	1	0.1	...	...	...	...
Dutch	7	...	1	0.1	...	...
Hungarians	...	0.5	4	0.2	2	0.2
Irish	38	2.7	29	1.8	14	1.1
Italians	100	7.1	139	8.1	119	9.4
Montenegrins	212	15.0	159	9.3	48	3.8
Norwegians	71	5.0	77	4.5	81	6.4
Russians	15	1.1	31	1.8	34	2.7
Roumanians	...	...	2	0.1	...	...
Scotch	59	4.2	71	4.1	63	5.0
Swiss	3	0.2	3	0.1	3	0.2
Swedes	87	6.2	111	6.5	90	7.1
Spanish	2	0.2	1	0.1	2	0.1
Welsh	...	...	2	0.1	2	0.1
Filipinos	2	0.2	2	0.1	2	0.1
Turks	2	0.2	6	0.3	6	0.5
Poles	1	0.1	...	...	2	0.1
Jews	...	...	1	0.1	...	...
Servians	...	...	1	0.1	4	0.3
Japanese	43	3.1	46	2.7	36	2.8
Indians	66	4.7	20	1.2	48	3.8
Totals	1401	100.0	1711	100.0	1272	100.0

A good deal of care is used in hiring the men. A card must be filled out for an applicant, stating his full name, position in which he desires to be employed, age, nationality, place of birth, whether married, name and residence of family, parents or nearest relative, where last employed and cause of leaving, whether a member of the Western Federation of Miners and whether he has read or had read to him the rules of the company. Another form, called a certificate of employment, is filled out with the same data and in addition, it is stated whether the applicant has suffered any physical injury, and in what other mines or public works he has worked, together with the names of one or more responsible persons for reference and a physical description.

#### SAFETY PRECAUTIONS

An exceptionally good set of instructions to employees has been prepared, including 29 separate sections; the following are quoted as illustrations of the manner in which a determined effort is being made to reduce the accident liability.

When returning to any place after a blast or blasts have been fired, each employee, upon entering such place, must make a careful examination for any loose rock or other ele-

ment of danger by which he could be injured, and if any such be found, he shall immediately make it safe, or if unable to do so himself shall report the same to the shiftboss or foreman before proceeding to work.

Miners who have blasted, on coming off shift, must notify the shift coming on if there have been any missed holes, and how many, so that they may have full knowledge of the matter. In such cases, also, the miners coming off shift must write plainly on the slate in the shaft house the place where they have left any missed holes and the number of such missed holes.

Miners driving drifts, crosscuts, or raises, which are to connect with other workings, must not blast when such drift, crosscut, or raise, is within 10 ft. of such other workings, before word has been sent to warn all employees to keep away from the vicinity when the connection is expected to be made.

All sticks or pieces of giant powder, fuse, or caps not used, must be taken from drifts or other places to places prepared in crosscuts, and not laid around the mine. Lighted candles or torches, or any other naked light, must not be taken into the magazines, or near capping benches, or places prepared for powder in crosscuts, or elsewhere, as these places are lighted by electric light. The temperature of magazine or other places where powder is kept must not exceed 65° F. Thermometers are furnished to test temperatures. If any thermometer is broken, the first employee discovering such breakage must immediately report it to the foreman. Smoking in or about any of the above places is strictly forbidden.

Engineers in charge of hoisting engines, at the change of shift and at meal times, shall first send down the skip or cage empty, to ascertain that the shaft is clear and safe, before lowering the men down the shaft.

It shall also be the duty of such engineers to daily inspect their hoisting rope and engine, to see that the same is in a safe condition and in proper repair; and if at any time the rope or any part of the machinery shall appear to be out of order, to have the same repaired before proceeding with the work.

#### ACCIDENT RECORD

The accident record of the Treadwell group of mines is, unfortunately, not complete. The statistical information is more or less conflicting and no accurate estimate has thus far been arrived at as regards the true number of men exposed to risk. It appears to have been the custom in the annual reports to construe the term "exposed to risk" to mean the total number of *different* men employed during the year. This, of course, is fallacious and the method yields an accident rate much below the truth. After carefully examining all of the available information, as derived from either the official annual reports, special statistics furnished by the mines, and data supplied by the U. S. Bureau of Labor, Table II was prepared and may be relied upon as representing the best possible estimate.

TABLE II—FATAL ACCIDENTS IN THE TREADWELL GROUP OF MINES, 1901-1913

	Estimated Average Number Employed	Number Fatal Accidents	Rate per 1000
1901	780	18	23.08
1902	978	13	13.29
1903	933	13	13.93
1904	916	5	5.46
1905	974	10	10.27
1906	937	5	5.34
1907	871	3	3.44
1908	1110	24	21.62
1909	1186	7	5.90
1910	1223	47	38.43
1911	1279	7	5.47
1912	1280	8	6.25
1913*	1260	3	4.60
1901-05	4581	59	12.88
1906-10	5327	86	16.14
1911-13*	3819	18	5.50
1901-13	13,727	163	13.79

\*Six months only for 1913.

The high death rate during the second five years, 38.43 per 1000, was due chiefly to an exceptionally serious accident in 1910. The average number employed has been arrived at with some difficulty, but the facts are given in full in the foregoing table, and the table at least provides the first reasonably trustworthy estimate of the probable



degree of accident frequency in lode mining operations in southeastern Alaska. The table has been verified, in part at least, by the statistics of production, and there are no reasons for believing but that, in a general way, the rates given represent the local accident liability with approximate accuracy.

No information has been published as regards the details of all of the fatal accidents which have occurred, but Table III exhibits the causes of 121 fatal accidents for the period 1902-1911:

TABLE III—CAUSES OF FATAL ACCIDENTS, TREADWELL GROUP OF MINES, 1901-1913

Causes	No. of Fatal Accidents	Per Cent. of Total
Explosions .....	44	36.3
Fall of rock .....	43	35.5
Falling in shafts, chutes, etc. ....	15	12.4
Fall from train, skip, or car .....	5	4.1
Broken sheave .....	3	2.5
Caught by shafting or belting .....	2	1.7
Suffocation by gas .....	2	1.7
Loading concentrates .....	2	1.7
On cars or skips .....	2	1.7
All other .....	3	2.4
Total .....	121	100.0

COMPENSATION PROVIDED BY COMMITTEE OF SAFETY

A thorough study of the accident problem in southeastern Alaska would provide material of much practical value to mining engineers and others interested in the accident problem. In view of the fact that the average fatality rate has been relatively extremely high, particularly during the early years covered by the previous table, it may be pointed out that during 1912 a Treadwell committee of safety was organized for the specific object of reducing the number of accidents. The committee is made up of 15 men, eight of whom are appointed by the Alaska labor union from its members, and seven are appointed by the general manager of the Treadwell company. A schedule of benefits was adopted by this committee to be paid to the beneficiaries of injured persons without reference to the question of legal responsibility. The benefits paid are given in detail, as follows:

BENEFITS IN CASE OF ACCIDENT, ADOPTED NOV. 4, 1912, BY THE TREADWELL COMMITTEE OF SAFETY

Fatal, no dependents, funeral expenses only.	
Fatal, married, living with wife, no children .....	\$1000
Fatal, married, living with family with children .....	1000
and for every child under 14 years of age .....	500
Fatal, not married, with sole dependents in the United States .....	1000
Fatal, married, with or without children, living in a foreign country .....	500
Fatal, unmarried, with widowed mother, sole dependent in a foreign country .....	500
Totally blind .....	2000
Loss of one eye .....	300
Loss of two limbs .....	1500
Loss of hand .....	500
Loss of foot .....	500
Loss of either leg above the knee .....	650
Loss of either leg below the knee .....	500
Loss of both legs above the knee .....	2000
Loss of both legs below the knee .....	2000
Loss of either arm above the elbow .....	650
Loss of both arms above the elbow .....	2000
Loss of either arm below the elbow .....	500
Loss of both arms below the elbow .....	2000
Loss of either thumb .....	200
Loss of either index finger .....	150
Loss of either middle, ring or little finger .....	100
Loss of an ear .....	100
Loss of the nose .....	150
Loss of the great toe .....	150

In all cases of fatal accidents funeral expenses, not exceeding \$125, will be allowed by the company.  
 In case of temporary disability injured party, if unmarried and living with no dependents, will receive no compensation other than that he is already entitled to, such as surgical attendance and hospital facilities.  
 If married and living with family at time of accident, he will receive no compensation for less than seven days and half wages for a period not exceeding three months for every day lost.  
 Amputations against the advice of the company surgeon will not be compensated for.  
 No relief under this schedule unless release is signed.

CONCLUSION

In concluding this brief account of the accident problem in southeastern Alaska, partly based upon personal

investigations, it requires to be said that the inquiry was far from conclusive or sufficiently comprehensive, considering the importance of the problem and the variations in local conditions which should properly be taken into account. The mining operations in southeastern Alaska cover a large area and many of the properties are operated under conditions quite typical of those of the Treadwell group. The labor conditions, however, are improving and more regard is being paid to safety precautions than in former years. Of the men employed at the Treadwell group during 1912 nearly 60% were former employees and 84% of the men had had previous experience in mining. It may also be said that 20% of the men employed during the year were married and the proportion of married men is increasing. Only 4.7% of the new employees were unable to speak English and only 31½% were unable to write. In due appreciation of the magnitude of the mining industry of Alaska, the problems of the safety, comfort and health of the employees are entitled to serious and sympathetic consideration. It is, therefore, to be hoped that the mine inspector will be provided with sufficient assistance to enable him to properly fulfill the responsible functions of his important office. It is also to be hoped that in the future the official inspection reports will contain some definite information in detail regarding the local hazards of mining throughout Alaska, with such suggestions and warnings as may be of practical value to both employers and employees.

Oklahoma Mining Law

In affirming a judgment for \$10,000 against the Big Jack Mining Co., of Lincolnville, Okla., for damages, on account of the death of a miner in the company's lead and zinc mine, caused by fall of a rock from the roof of a drift, the Oklahoma Supreme Court decided that the statutes of that state, which make it the duty of the operator of any coal or "other" mine to provide a mine foreman, and which require the foreman or his assistant to make daily inspections of places where miners are required to go, to direct roofs to be properly timbered, and to prevent men from working in unsafe places, except for the purpose of making them safe, apply to lead and zinc mines, as well as to coal mines.

It was further decided in this case (137 *Pacific Reporter*, p. 678) that, where a miner is killed in Oklahoma through negligence attributable to his employer and he leaves no estate to be administered, suit for his death is properly brought by his widow for the benefit of herself and his surviving minor children; and that the damages to be recovered are measurable by the actual pecuniary loss resulting to the family on account of the loss of their protection and support by decedent, considered with reference to his life expectancy, earning capacity and the use to which he had devoted his earnings.

Silesian Zinc Industry

According to reports in the *Chemical Trade Journal*, Feb. 21, 1914, the production of raw zinc in Upper Silesia last year amounted to approximately the same as in 1912, which latter year's production showed an increase of 11.2% over 1911. It will therefore be seen that the development of the zinc industry in 1913 was far from satisfactory. For years the industry had been

greatly retarded through manufacturers being able to dispose of their production of sulphuric acid only at considerable loss, on account of the abnormally high railway tariff on this commodity. The efforts which have been made during the past 12 months to lower the tariff on sulphuric acid have, however, been partially successful, which is all the more significant inasmuch as the production of sulphuric acid in Upper Silesia is increasing rapidly from year to year, and with it the heavy demands which had resulted from the requirements of the blende-smelting trade. In 1900 the production of sulphuric acid per ton of raw zinc amounted to only 0.08 metric ton; in 1905 it had increased tenfold to 0.85 metric ton; and last year it still further increased to 1.34 metric ton. The production of sheet zinc increased by about 5487 metric tons, or about 9.7%. As far as prices were concerned, the year was quite satisfactory, as the average value of raw zinc increased by 8.6%, and of sheet zinc by 9.2 per cent.

### Cyaniding Silver Ore at Ocampo, Mexico\*

The Sierra Consolidated Mines Co. owns much of the productive mineral area in the Ocampo district. Since its discovery, the camp has produced bullion valued at over \$50,000,000. The deepest mine, the Santa Juliana, was worked 1100 ft. below the outcrop.

The ore is practically all argentite, with some gold carried in a siliceous gangue. The typical ledge matter is an andesite breccia cemented with quartz, or quartz stockwork in andesite.<sup>1</sup> The proportion by weight of silver to gold averages about 60 to 1. The silver sulphides occur ordinarily rather fine. The ledges also contain considerable pyrites, usually barren.

Ores from the principal mines are shown in the accompanying table:

	Per Cent.	Per Cent.	Per Cent.
Insoluble .....	82.50	82.15	83.80
Fe .....	3.70	5.05	2.47
CaO .....	4.75	3.55	4.50
MgO .....	3.27	3.75	1.42
S .....	0.22	0.50	0.20
Al <sub>2</sub> O <sub>3</sub> .....	1.61	2.34	2.13
MnO <sub>2</sub> .....	0.55	0.28	0.31
Cu .....	0.01	Nil	Nil
As .....	Trace	Trace	Nil
Sb .....	Trace	Nil	Nil
Loss in ignition.....	2.41	2.00	4.20
<b>Total</b> .....	<b>99.02</b>	<b>99.62</b>	<b>99.03</b>
Ounces Ag.....	16.55	88.30	11.10
Ounces Au.....	0.25	1.08	0.36
Acidity of ore (terms NaO H).....	0.20	0.39	0.25

The character of the metallic constituents of the ore is better shown by the analysis of concentrates and concentration tailings in the accompanying table:

	Concentrates Per Cent.	Tailings Per Cent.
Insoluble .....	31.40	86.30
Fe .....	32.00	2.80
CaO .....	2.40	3.40
MgO .....	0.60	0.80
S .....	17.90	0.36
Al <sub>2</sub> O <sub>3</sub> .....	0.70	1.78
MnO <sub>2</sub> .....	0.47	0.57
Cu .....	1.10	Nil
As .....	0.28	Trace
Sb .....	Trace	Nil
Ounces Ag.....	1376.00	11.20
Ounces Au.....	23.40	0.15

\*An extract from an article by Robert Linton in "Bull." A. I. M. E., February, 1914.

<sup>1</sup>The geology of the Ocampo district is described in Eng. and Min. Journ., Oct. 5, 1912.

Recasting the analysis of the concentrates, the mineralogical composition would be about as shown in the table:

	Per Cent.	Per Cent.
Iron pyrites.....	30.2	
Chalcopyrite.....	3.0	
Arsenopyrite.....	0.7	
Argentite.....	5.4	
<b>Total sulphides.....</b>	<b>39.8</b>	
Oxides and silicates.....	49.0	
Carbonates.....	5.4	
Metallies.....	5.8	
<b>Total.....</b>	<b>100.0</b>	

Six mills had been operated in connection with the mines now owned by the company. One used Bryan mills for crushing, all of the others light stamps, the total capacity aggregating 90 stamps. All of these mills but the one at El Salto had been out of operation for some time and had been dismantled.

Until about seven years ago the treatment followed was plate amalgamation, or more frequently pan amalgamation, followed by concentration on Wilfley tables and vanners, with pan amalgamation of the concentrates. Records of these milling operations are incomplete and probably not very reliable as regards the extraction obtained. A general idea of the results may be gained from the following extract from these records:

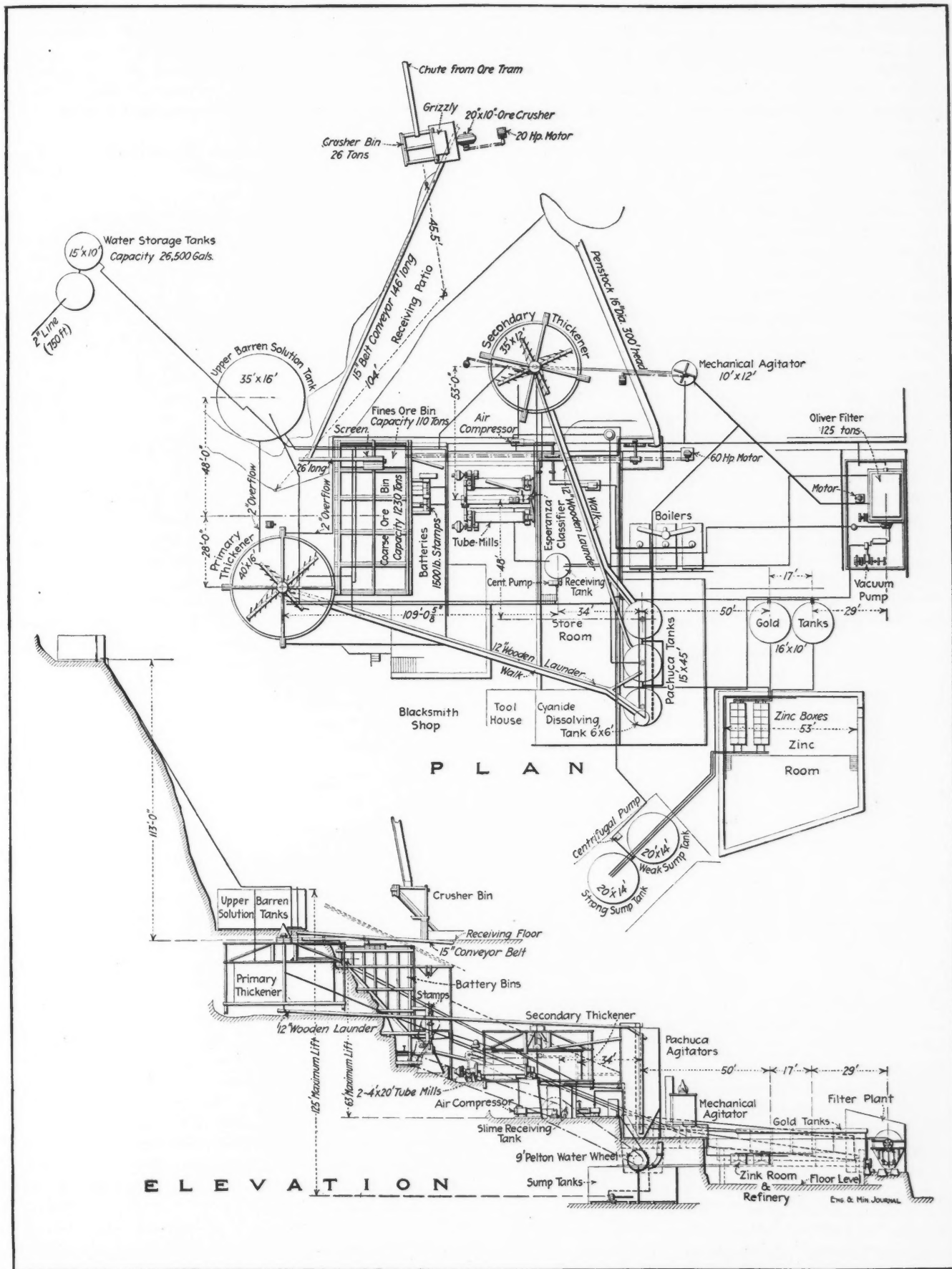
Mill	Extraction		Bullion Fineness	Milling Costs Per Ton
	Au. Per Cent.	Au. Per Cent.		
Santa Juliana.....	62	55	946	\$4.09
San Ramon.....	79	64	981	
Belen.....	64	46	991	5.01
Rosario.....	73	51	971	3.25

The extraction figures are based on the assays of heads and tailings. The actual recovery made in these old mills probably did not average over 60% of the gold and 50% of the silver contents of the ore.

The first cyanide plant in Ocampo was installed in 1906 at the pan amalgamation mill at El Salto. In this mill the battery pulp was run over Wilfley tables and the coarse sulphides concentrated, the concentrates being then treated by grinding in strong cyanide solution in one of the old amalgamating pans. The sands were drained as dry as possible in the collecting tanks and transferred to the leaching tanks in a small car; the thickened slimes (about 2.5:1) flowed directly to the Pachucas. The sands treatment appears to have required about 20 to 25 days and the slimes treatment 8 to 10 days, of which a total of about 30 to 35 hours was actual agitation in strong solution, the remainder being taken up with decantation and washing. From such records as are available covering the operation of this mill, a recovery of about 70% for both gold and silver has been about the average, with cyanide consumption of above 5 lb. per ton ore, a considerable portion of which was lost in waste solutions. Milling costs averaged around \$5 per ton.

On account of the worn-out condition and inefficient arrangement and equipment of this cyanide mill, no attempt was made by the Sierra company to operate it regularly. It was, however, utilized to good advantage for test runs to determine the details of treatment that would yield the best commercial returns, taking into consideration extraction, cost and time required. The ore milled was limited to what was produced in the course of development work. Altogether 4700 tons were milled, from which bullion was produced with a total value of \$45,274, U. S. currency.





MILL OF THE SIERRA MINING CO., OCAMPO, CHIHUAHUA, MEXICO

As the Pachuca tanks operated in parallel, it was easy to vary the treatment on individual charges of slime, as well as sands, and in this way improved results were soon obtained. The time of treatment of the sands charges was reduced to 18 days, concentration was eliminated, a spitzlütte was placed ahead of the Butters distributor, the proper strength of solution determined and the percentage of extraction was materially raised. Careful records were kept of the individual charges under special treatment and the results plotted graphically.

The operation of the mill showed that leaching should be eliminated. Where the treatment of the individual slimes charge was considered separately and compared with the sands charge under treatment for the same length of time, the latter would contain at least three times as much gold and four times as much silver as the slimes residues.

In the ore, the elements ordinarily met with which are objectionable from the standpoint of cyanide treatment, such as copper, arsenic, antimony and sulphur, if present at all, occur in such small quantities as to exert practically no influence on the treatment. As far as the manganese is concerned, the silver values do not appear to be in any case combined with it to form a refractory manganiferous silver ore, such as is met with rather frequently in Mexico.<sup>2</sup>

The supply of lime that has been previously available is quite impure, but contains nothing prejudicial to cyanide operations. Fifty pounds of lime digested for six hours with a ton of standard KCy solution showed no cyanide consumption, so that this lime could be used.

#### EXPERIMENTS CONDUCTED IN A 10x30-IN. PACHUCA TANK

A model Pachuca tank, 10 in. in diameter by 30 in. high, connected with small zinc boxes, was rigged up for experimental work. Twenty-five- to fifty-pound samples were treated in this, and the details of treatment were worked out here, and subsequently checked by agitation of 20-ton charges in the cyanide plant. The ore was ground to 120-, 150- and 200-mesh; solutions of different strengths were used, and the various conditions influencing the treatment thoroughly tested out. Without going into the numerous details in connection with these tests, the results may be summarized as follows:

It was not possible to obtain nearly as high extraction with pulp ground to 120- or 150-mesh as with that ground to 200-mesh, demonstrating the necessity of fine grinding.

The strength of solution most favorable for treatment of this ore is about 0.32% KCy. Weaker solutions can be used to obtain equally high extraction if the time of treatment be increased. With this strength of solution the period of agitation necessary for extraction percentage as given below was 34 hours.

Protective alkalinity should be maintained during agitation up to 0.08. The use of lead acetate was found to be of no benefit in connection with the treatment. The consumption of cyanide averaged about 1.4 lb. per ton ore milled and consumption of lime about 12 lb. with the treatment as outlined above. These are the actual amounts of materials destroyed by the reactions of the process. Taking mechanical losses into consideration,

there would probably be in a working plant a consumption of about 2.5 lb., 98% potassium cyanide and 15 to 20 lb. lime per ton ore treated.

The extraction of silver from samples ground to 200-mesh varied from 84 to 89%; the gold extraction from 93 to 95%. A recovery of 85% should be effected in operating.

A series of tests was also made on cyaniding the concentrates. The writer has already given details of these in a previous paper.<sup>3</sup> The results indicated that the most economical treatment was to grind the concentrates in 0.2% KCy solution, agitate in a 0.6% KCy solution, which was raised to 0.8% toward the end of the treatment, the protective alkalinity being maintained at 0.10. The use of lead acetate did not benefit the extraction, but a small amount assisted in keeping the solutions clear. In treating ore of ordinary grade there is no benefit to be derived from concentrating. It may be of advantage in handling the rich ore from bonanza shoots, such as the mines have yielded from time to time in past operations and which appear to be characteristic of the ore occurrence here. In the new mill, concentrating equipment is not provided but the mill is so designed that it can be added when needed.

After the metallurgical details had been worked out a cyanide mill was designed, which follows closely the outline of treatment derived from this preliminary work. The site selected was El Salto, where the old cyanide mill was situated, as it is the most favorable one considered both from standpoint of contour of the ground and transportation of ore from the mines. The machinery for the first unit of this mill was ordered and construction work had been begun when it was decided to suspend operations until political conditions in Mexico should become more settled. The accompanying drawings show the equipment and arrangement as planned.

## Dolcoath Mine

LONDON CORRESPONDENCE

The annual general meeting, held on Feb. 26, was pessimistic. Owing to the somewhat diminished tonnage treated; a reduction in value by 0.9 lb. of tin per ton; and a drop of £26 14s. in the price of block tin as compared with the previous half year, the receipts dropped £26,000 and a dividend at the rate of only 2½% for the half year was agreed to.

The meeting was in strong contrast to the tone of the last annual meeting when ore containing high tin values had been reached in the lower development levels. These proved to be only rich patches and at the present moment but little ore running 30 lb. tin to the ton, about the value of the ore now being milled, is being developed. There is, however, much promising undeveloped ground both east and west in depth and good reason to suppose that more 30-lb. ore will be found during the next six months development.

Nothing was said about the tonnage of profitable ore now in sight and, judging from past experience, there is but little hope of getting the information. One is led to wonder if the management itself knows, and, if so, why this important information is so carefully kept from the shareholders.

<sup>2</sup>Experiments on such an ore are described in a paper by the writer published in the "Journal" of the Chemical, Metallurgical and Mining Society of South Africa, September, 1908.

<sup>3</sup>"Journal" of the Chemical, Metallurgical and Mining Society of South Africa, July, 1912.



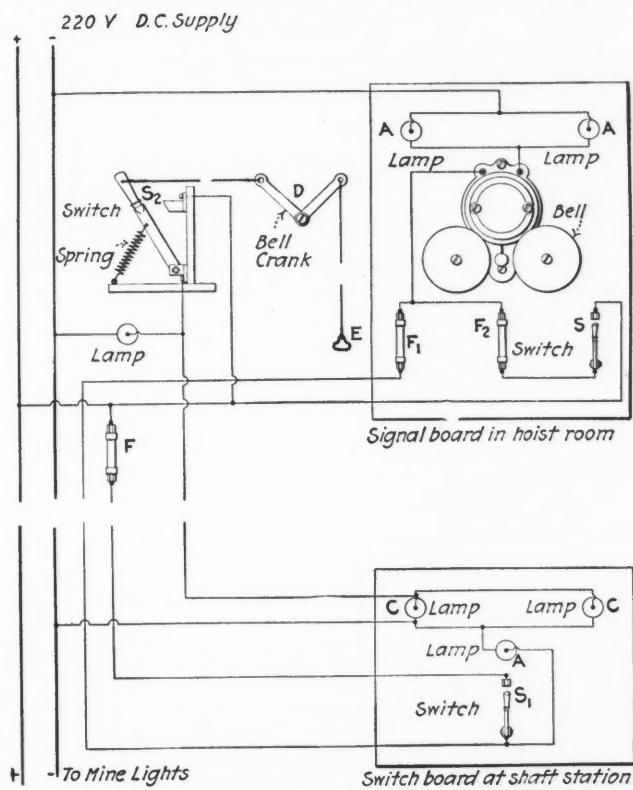
# Details of Practical Mining

## Simple Electric Signaling System

By H. R. WASS\*

The accompanying diagram illustrates a homemade electric signaling system installed at the Rosiclare Lead & Fluorspar company's mines at Rosiclare, Ill. It is used for signaling between the shaft station on the ore-hoisting level and the hoist room on the surface. It is simple, reliable, and has so far proved efficient, and it was easily and cheaply installed.

The signal board in the hoist room is about 12x18 in. in size, built of hard pine and painted with two coats of P. & B. paint. The switchboard at the shaft station is



LAYOUT FOR MINE-SIGNAL SYSTEM PROVIDING FOR RETURN BY ENGINEER

made of the same material and painted in the same manner and is protected from dripping water by a wooden canopy. All wiring is double-braid rubber-covered and is carried down the shaft, on the mine level and in the shaft station, in metal conduit and is fully protected from mechanical injury.

The method of operation is as follows: To hoist, the cager closes the switch *S1*, a single-pole, single-throw, knife switch, and holds it closed for two or three seconds; this lights the lamps *A* and rings the bell in the

hoist room. The two lamps *A* are in series with the bell to furnish the necessary resistance.

The hoisting engineer responds by pulling down on *E*, which closes the switch *S2*, also a single-pole, single-throw, knife switch, which is held open normally by the spring; this operation causes the lamps marked *C* to light up and remain lighted until the spring pulls the switch open. Two of these lamps are on the switchboard in the shaft station and the other is located conveniently to the engineer's operating platform so that he may observe whether or not the cager receives his return signal. All of the signals are repeated by the hoisting engineer after the underground signals are received by him and all misunderstanding of signals is thus avoided. [This probably does not apply to stop signals, if such are used.—EDITOR.] *D* is a simple bell crank forged from 1/4x1-in. bar and connected to the handle of the switch by a small rope. The switch is mounted on a wooden frame as shown, or may be placed in any other convenient position.

At *F* and *F1* are 5-amp. fuses. Whenever the engineer or electrician wishes to test or adjust the bells, he simply removes the fuse from *F1*, places it in the socket at *F2* and closes the switch *S* which rings the bell and lights the lamps *A*.

All lamps are carbon filament, 50-watt, 220-volt lamps working on a 220-volt direct current. The bell is of a weatherproof ironclad type, wound to a resistance of 30 ohms; it consumes 0.3 amp of current.



## Deep Diamond-Drill Hole with Light Equipment

By P. W. DONOVAN\*

In August, of 1909, there was completed on the eastern end of the Mesabi range, a diamond drill hole 2745 ft. deep. Special interest attaches to it as being unusually deep and as having been drilled with a relatively light rig.

The hole was put down by E. J. Longyear, for the Longyear Mesabi Land and Iron Co., in Sec. 30, T. 58 R. 15, south of the village of Aurora and about three and one-half miles south of the southern boundary of the supposed iron-bearing zone. The formations passed through were as follows: Glacial drift, 183 ft.; black slate, 1974 ft.; taconite (the iron-bearing formation), 569 ft.; quartzite, 19 ft. The 20 ft. immediately above the taconite was an exceptionally hard noncrystalline slate, almost like agate, and so resistant that the diamond bit could do little better than 2 ft. per 10-hour shift in it.

The hole was commenced on Nov. 26, 1908, and finished Aug. 13, 1909. Ordinary 3-in. casing or standpipe was driven through the glacial drift in the usual manner. Diamond drilling was begun at 183 ft. with a hy-

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\*Superintendent on the Cuyuna Range for E. J. Longyear Co., Brainerd, Minn.

draulic drill, using "E" rods, which gave a hole  $1\frac{1}{8}$  in. in diameter. At 2527 ft. the hydraulic drill was replaced with a Longyear drill, type No. 3, and with it the hole was completed, "E" rods being used throughout. A  $\frac{1}{2}$ -in. crucible-steel cable leading over a fixed sheave wheel, and provided with a running pulley, was used for lowering and raising the rods. The tripod, consisting of three tamarack poles, crossbraced and joined at the base with 12-in. logs, was of such height as to permit handling the rods in 30-ft. lengths.

The time required for raising and lowering the rods occupied a constantly increasing proportion of the working time as the depth of the hole increased. In the earlier part of the hole in the slate the rods had only to be raised every 10 ft., that being the capacity of the core barrel. More frequent pulls were often necessary in certain material on account of the bit blocking so as not to permit the passage of the wash water. The hole was drilled in two 10-hr. shifts, with a drill runner and helper on each shift and a woodcutter on the day shift. The men lived in a camp near the drill.

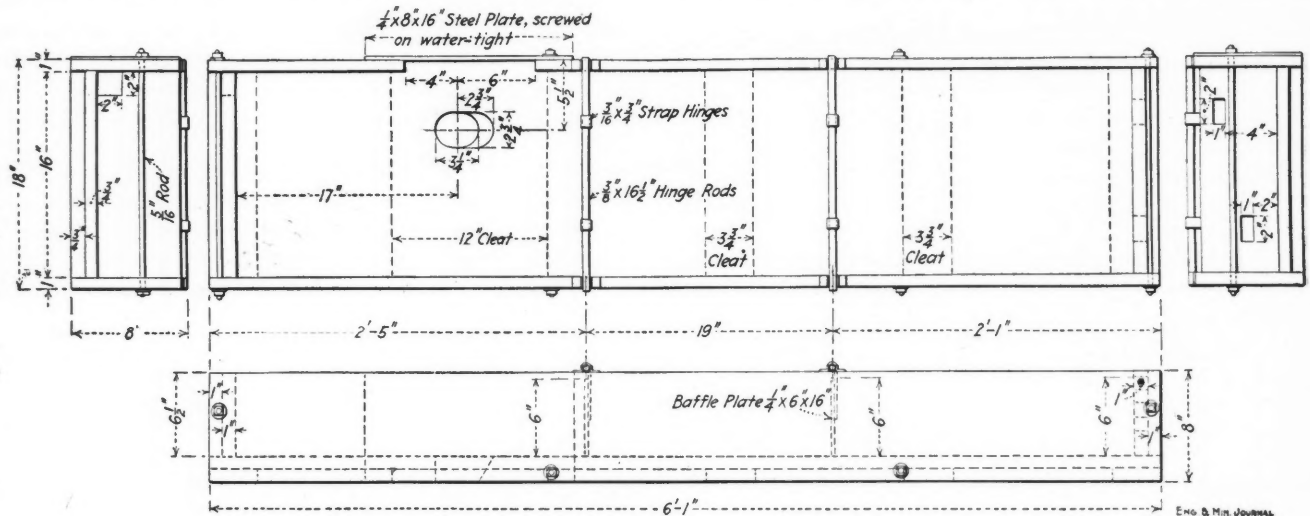
keep the roads dry and the use of chains to give traction cut the road up so badly that the use of the truck had to be discontinued and it was eventually sold.

### Improved Sludge Box for Diamond Drilling

BY GEORGE S. ROLLIN\*

The sludge box here illustrated is designed to catch the sludge sample from diamond drilling. Its position, surrounding the casing inside the drilling shanty, is a point of advantage, especially in winter, since the necessity of going outside the shanty to collect the sample in cold weather often leads to carelessness in the sampling. Here drill runner and helper check each other in the matter. The box is light, portable and has been proved by experiment to be efficient in catching practically all the sludge.

The dimensions and general method of construction are evident from the drawing. The bottom is perforated



IMPROVED BOX FOR CATCHING DIAMOND DRILL SLUDGE SAMPLES

As far as known, this hole is one of the deepest ever drilled on the Minnesota iron ranges. Considering its great depth, it adhered remarkably close to a true vertical course. When completed, inclination tests were made at four different points, giving the following results: At 1230 ft.,  $86\frac{1}{2}^\circ$ ; at 1740 ft.,  $86\frac{1}{2}^\circ$ ; at 2250 ft.,  $86\frac{1}{2}^\circ$ ; at 2745 ft. (bottom),  $86^\circ$ .

### Experience with a Motor Truck

The management of the Alaska-Gastineau reports its experience with motor-truck haulage as follows: A  $3\frac{1}{2}$ -ton Alco was purchased for the purpose of hauling supplies and material from the town of Juneau to the Perseverance camp, a distance of  $4\frac{1}{2}$  miles, with a grade of from 2% to 10%. The truck worked satisfactorily during the early months of the year, when the weather was dry and during this period was found more economical than hauling with horses on account of the excessive cost of the upkeep of teams in this part of Alaska, but during the later months, namely August to December, the truck was a failure on account of the heavy rainfall which occurs in this particular section. It was impossible to

near the upper end to permit the 2-in. casing to pass. The opening is made tapering to have it available for inclined holes, and is packed around the casing when in place to make a tight joint. The use of old hemp packing below with a washer cut from a used rubber Cameron-pump valve to fit tightly around the casing has been found convenient for this purpose. Opposite the hole, the side of the box is cut out and the space covered with a steel plate; in this manner the chuck has room to revolve freely. Otherwise the side of the box would interfere with the revolving of the chuck when fed down, since the space between the casing and the frame of the machine is limited.

The box is built of 1-in. stuff, nailed and bolted together. Probably the construction would be bettered by the use of a solid 2-in. bottom. It is lined inside with No. 26 galvanized iron having soldered joints. Two baffles of  $\frac{1}{4}$ -in. plate are set across the box, fitting snug to sides and bottom, their tops even with the front end of the box over which the water escapes, in operation, since it is somewhat lower than the sides. To these baf-

\*Formerly district superintendent, E. J. Longyear Co., Crystal Falls, Mich.



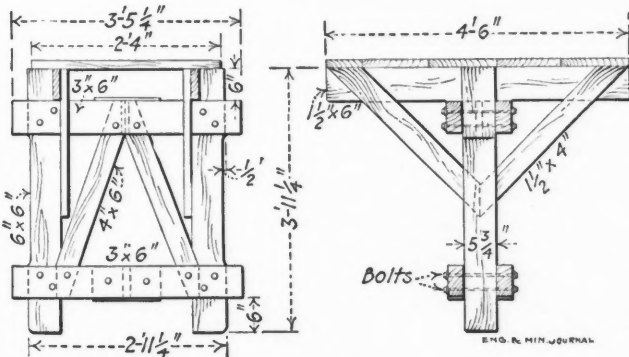
fles are riveted hinge pieces, which are supported by a  $\frac{3}{8}$ -in. rod, resting between short sections of small angles nailed to the box sides. In the front of the box are two 1x2-in. openings disposed as shown and at the back is a 2x2-in. opening in one of the lower corners. The galvanized-iron lining is extended through these holes.

The holes are stopped with plugs while the drill is running. The bottom of the box is slightly raised in front. This aids in slowing up the flow of water along the bottom of the box and permits a better settling of the sample as the sludge water passes along. Most of the sludge collects in the first compartment against the baffle, a smaller amount against the second baffle and but little in the third compartment. When the sample is to be collected, the baffles are lifted out, and the plug pulled in the upper of the 1x2-in. holes. When the water has drained to the level of this hole, the plug in the lower 1x2-in. hole is pulled, leaving but 2 in. of water in the box. The 2x2-in. plug is then pulled and the slight slant toward the back permits draining off the remaining water with practically no disturbance of the sludge. This is a feature of considerable advantage over the usual type of sludge retainer where some percentage of the sample is usually lost in the collection. The sample, thus drained so far as possible, is taken from the box and slowly dried in sheet-iron pans.

### A Bucket Crosshead

By E. M. HOBART\*

In many isolated mines, safety, when hoisting buckets are used, cannot be obtained on short notice. In such cases the crosshead shown in the accompanying illustration has advantages for temporary use.



BUCKET CROSSHEAD WITH PLATFORM FOR LOWERING MEN

One occasion arose when it was necessary to demolish a wooden headframe over a 1400-ft. shaft, in order to erect a steel structure in its place and at the same time re-timber the shaft. One sheave was placed on the center-post section of the old frame, which sufficed as a temporary frame with the addition of a few braces, but was not strong enough to support a cage. The addition of a platform, as shown in the illustration, to the crosshead, solved the problem of lowering men. The platform accommodated six men, and the bucket was attached to a chain below the crosshead sufficiently long to lower 15-ft. timbers.

\*Mining engineer, Morenci, Ariz.

### Don'ts for Electricians

- Don't use open fuses.
  - handle moving belts.
  - use rotten belts.
  - neglect storage batteries.
  - overfuse circuits.
  - allow belts to slip.
  - throw water on burning oil.
  - use acid salts in soldering.
  - leave joints without soldering.
  - put too much tension on brushes.
  - put water on hot bearings.
  - use emery cloth on brushes or commutators.
  - fail to replace cracked insulators.
  - step over, under, or through moving belts.
  - strip the threads on foundation bolts.
  - use pliers with uninsulated handles.
  - burn wire insulation when soldering joints.
  - burn knife-switch contacts by slow opening.
  - hang clothing on other material on wiring.
  - use high-potential leads that are not properly insulated.
- leave tools lying near a motor or generator.
- expose machinery or apparatus to moisture.
- use lubricating oil in transformers.
- use in transformers oil which has been exposed to moisture.
- put a motor or generator on a shaky foundation.
- run a booster without a speed-limiting device.
- install outdoor circuits without lightning arresters.
- do wiring without consulting the underwriters' rules.
- try to save wire by freak layout of circuits.
- leave loose or dirty contacts on switchboards.
- forget the value of sand in fighting electrical fires.
- meddle with circuits you are not familiar with.
- run motors and generators without inspecting the bearings occasionally.
- put up wiring without the proper fuses or circuit-breakers.
- attempt to adjust series arc lamps with the current on.
- start a motor without making sure that the field circuit is all right.
- run a motor with a weak field.
- make adjustments on motors and generators when they are running; this applies particularly to brushes.
- bring a motor up to speed too fast in starting.
- send a new man on a job which he does not thoroughly understand; it is dangerous for all concerned.
- cut the blades on knife switches by adjusting the contacts too tight.
- block up the space in front of switchboards so that the switches cannot be reached immediately.
- do high potential testing, without first erecting red danger signs.
- get your face over commutators, as there is always danger of a flash over.
- handle meters roughly.

Note.—Reprinted from an article by H. M. Nichols in "Power," Dec. 9, 1913.

- expose your watch to heavy currents.
- fail to read regularly a good engineering paper.
- run a motor or generator until the windings get hot enough to smoke.
- operate transformers without having the secondary windings grounded.
- discharge storage batteries too low, and don't let them stand when discharged.
- install conduit without grounding it.
- leave packing boxes and other inflammable materials in the power house.
- burn the contact buttons on starting boxes.
- use brushes that are not properly fitted.
- use both hands when working on live apparatus.
- leave joints without taping.
- fail to attach a wiring diagram to each switchboard.
- run a belt with the tight side on top.
- run a motor or generator with a loose pulley.
- use pulleys or couplings having exposed set-screws or bolts.
- neglect to fence in all exposed belts and shafting.
- allow dirt and oil to collect on the windings of motors and generators.
- use the back of switchboards as clothes racks.
- fail to treat every wire as though it were alive, until you have determined otherwise.
- stop a motor without seeing that the rheostat arm falls back to the starting position.
- lean against machines or switchboards.
- open a main feeder switch, under full load, except in the case of an emergency.
- fail to renew the oil occasionally in the bearings of motors and generators.
- use rigid couplings if flexible are possible.
- connect alternating-current generators in parallel without first being sure they are in synchronism.
- run a motor or generator with loose polepieces.
- fail to ground lightning arresters.
- spill oil on the floor.
- store gasoline in the power station.
- handle the blow torch carelessly around inflammable materials.
- neglect to remove temporary wiring.
- use copper wire to replace blown fuses.
- use plugs for series arc switchboards having defective handles or frayed leads.
- forget that 500 volts, or less, is sometimes fatal.
- run a badly vibrating motor or generator.
- couple two machines together without making sure that the alignment is perfect.
- start a new motor for the first time without making sure that the armature turns freely.
- install rheostats and other sources of heat without separating them from inflammable materials.
- use wooden switchboards.
- drive nails where there is danger of their coming in contact with concealed wiring.
- put telephone or other signal wires above power wires.
- cut open a cable and leave it exposed to moisture.
- stop a motor by releasing the starting rheostat arm, without having first opened the main switch.

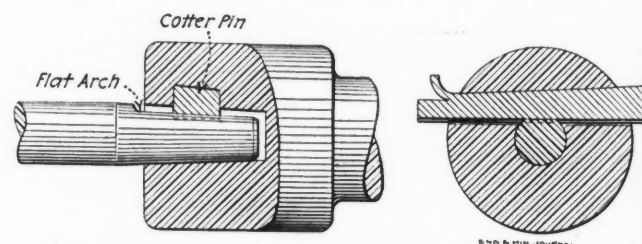
- cut the strands in skinning lamp-cord insulation.
- throw a switch unless you know positively to what circuit it is connected.
- leave oily waste in any place except metal waste cans.
- fail to use the proper size starting rheostats for motors.
- allow a single-phase induction motor to run on the starting winding.
- neglect to run down grounds, and remedy them as soon as they show up on the ground detector.
- start a series motor without first making sure that it is properly loaded, to hold down the speed.
- forget that there is danger of injury from short-circuits on low-tension wiring, when tools are handled carelessly around bare contacts.
- fail to consult the nameplates on motors and generators and make sure of having the proper voltage, before putting them in service.
- start a motor by throwing in the main switch, without first seeing that the starting rheostat arm is in the off position.
- connecting different makes of transformers in parallel without making sure that their polarity is the same.
- open the field switch on a generator with the resistance all cut out of the control rheostat.
- forget that there is always a possibility of low-voltage wires becoming dangerous, by accidental contact with high-voltage wires.

✂

## Unusual Rock-Drill Chuck

BY A. LIVINGSTONE OKE\*

The illustration represents diagrammatically a simple form of rock-drill chuck, invented by G. P. Jones, manager of the Nickel Plate Mine, at Hedley, B. C., and found to be entirely satisfactory in use. It differs from



DRILL CHUCK WITH WEDGE SET TRANSVERSELY

other types of wedge chuck in having no collar and in having the wedge set crosswise. A conical hole in the chuck receives the tapered end of the drill steel. On this tapered end, a flat is filed, as shown. In the chuck, a peculiarly shaped cotter is placed transversely and the drill steel tightens up against this, under the effect of the drilling blows. To insert a new piece of steel, the cotter is first pushed in as far as it will go, then the steel put in and air turned on lightly. To loosen the steel, a light blow on the thin end of the cotter is sufficient; the piece shown split and turned back, prevents it from dropping out.

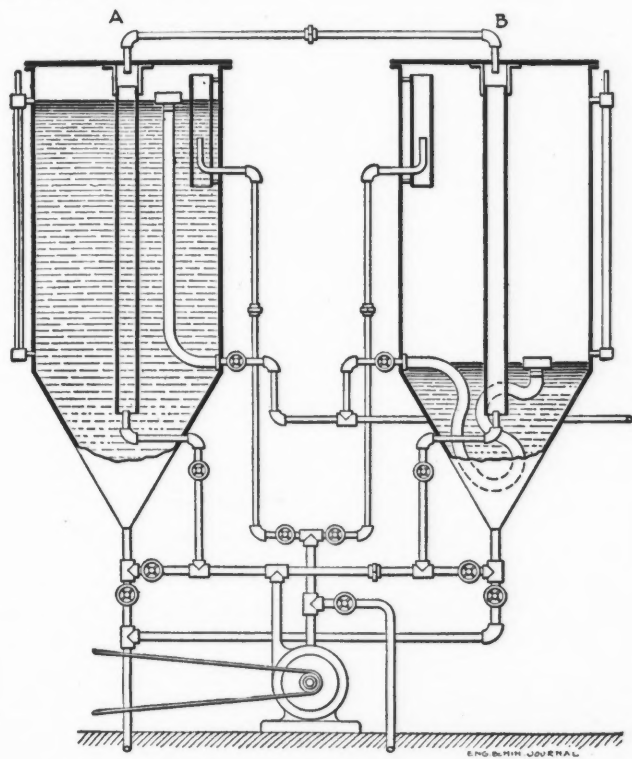
\*Mining engineer, Penzance, Cornwall, England.



# Details of Metallurgical Practice

## Bretherton Ammonia Apparatus

The recovery of copper and zinc from ores by an ammonia-leaching process has been recognized as a possible solution of complex-ore problems, but our difficulty has been the recovery of the ammonia once used, or the prevention of its loss. Up to the present time no absolutely successful method has been presented. In order to put the process on a practical basis, S. E. Bretherton, of Berkeley, Calif., has devised an apparatus (U. S. patent No. 1,082,797), which he believes will avoid the troubles formerly encountered.



AGITATORS FOR AMMONIA TREATMENT

Two similar agitators are arranged close to each other, as shown in the drawing. From the apexes of the cone bottom, pipes are connected by branches with the discharge pipe of a pump, the latter being driven by a motor. The inlet pipe of the pump is connected by branches with various tanks (not shown) for pumping solutions needed in the process. From the branch pipes extend other pipes which enter the agitators and terminate at the lower end of the agitating lift-tubes. The inlet pipe of the pump also has connections extending into the clear-settling tubes shown just inside the tanks. Decanters are connected by flexible tubes with pipes which lead to another pipe that is connected with a sump for receiving solution decanted from the agitators. Gages are arranged on the sides of the agitators to show the height of pulp in each. The closed tops of the agitators

are connected with each other by overhead pipe for conducting gases back and forth during decantation and filling of the agitators. Means for discharging treated pulp from the agitators is provided in the pipes from the cone bottoms. The discharged pulp may be conducted to filters or leaching tanks for the extraction of contained gold and silver.

The cycle of operations is as follows: Filling A (decanting wash B); agitating A (removing residue B); decanting A (filling B); rest (agitating B); filling wash A (decanting B); agitating wash A (rest); decanting wash A (filling wash B); removing residue A (agitating wash B). It is to be understood, of course, that the necessary valves are operated in connection with these steps.

In the operation described, it will be seen that decantation is effected without the admission of atmospheric air, since the gas contained in either agitator may flow into the other during decantation, and back again during the collecting of a new charge. Thus the dilution of the gas is prevented and the impairment of the decanting process avoided.

## Mastic Lining for Acid Tanks

BY D. T. PIERCE\*

In connection with the operations of the Chile Exploration Co., in Chuquicamata, Chile, there has been developed a new method of lining concrete tanks, which are subject to the action of sulphuric acid.

The company's copper ores in Chile are handled by sulphuric-acid leaching and electrolysis. After the ore is crushed it is put into large tanks, and then leached with a 10% sulphuric-acid solution for 24 hr. The solution containing the copper is put through another process for extracting the chlorine and then passes to the electrolytic tanks. There the copper is extracted and the remaining solution, in which the sulphuric acid is now regenerated, is then returned to the leaching tanks ready for extracting the copper from a new batch of ore.

It can readily be seen that the large tanks required must be such as will withstand sulphuric acid, which, of course, concrete would not do unless provided with a protective lining. Experiments with tanks of various types were made, but in most instances proved failures. It was then suggested that an especially prepared acid-proof asphaltic mastic lining might be used to overcome the difficulties encountered. In cooperation with E. A. Cappelen Smith, consulting metallurgical engineer of the Chile Exploration Co., experimental tanks, among them one 15 ft. deep, lined with Trinidad asphalt mastic, were installed at the research laboratory of the American Smelting & Refining Co., Maurer, N. J. With these tanks there was duplicated as nearly as possible the operation of extracting copper as it will be carried out in Chuquicamata.

\*Executive assistant, Barber Asphalt Paving Co., Philadelphia, Penn.

Under the direction of Mr. Smith various other materials were also experimented with at Maurer, but they all proved unsuitable, with the exception of the asphaltic mastic. It was on the strength of this material, having shown no defects or deterioration after a year's test, that the Chile Exploration Co. has placed the contract for lining with asphaltic mastic its concrete tanks from 15 to 16 ft. in depth and from 120 to 150 ft. square.

The lining of these tanks in Chile will require from 1250 to 2000 tons of asphalt mastic, which is being prepared here and shipped to Chile. The first cargo of 500 tons was shipped in February, and as soon as it arrives, which will take about three months, as the ship has to go around the Horn, an experienced superintendent and nine mastic workers will be sent to Chile to do the lining of the tanks.

The experimental work at Maurer, the preparation of the asphalt mastic and its application to the concrete tanks was carried out by Henry Wiederhold, manager of the Vulcanite Paving Co.

## Mortar Foundations

BY ALGERNON DEL MAR\*

Stamp-mill construction, like all other engineering details, is becoming standardized by the elimination of the undesirable structures. The cycle of evolutionary

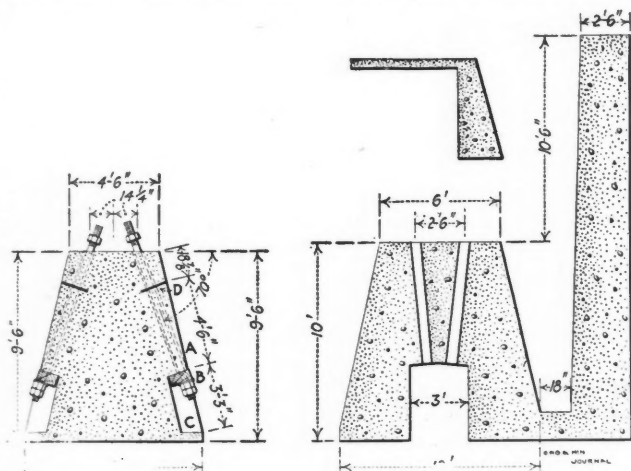


FIG. 1.

FIG. 2.

FORMS OF MORTAR FOUNDATIONS

changes follows the general laws of evolution; first the primitive forms; then the elaboration due to many minds working in different directions; then the simplification due to many minds working in the same direction.

That we have not yet attained the standard form is proved by the structures erected in recent years. In this paper mortar foundations particularly are dealt with.

All forms of mortar foundation where the hold-down bolts are solidly embedded in the concrete may be eliminated as being inferior, inasmuch as a broken bolt cannot be replaced; a serious consideration with the heavy stamps now coming into use. I am inclined to think that most of our new construction, particularly in the United States, will be for stamps weighing between 1500 and 1600 lb. The 2000 lb. stamps erected on the Rand have been successful so far as the crushing is concerned but

\*Mining engineer, South Pasadena, Calif.

have been hard on the concrete foundations, not on account of the nature of concrete, but the form of mortar foundation. The City Deep (Rand) form, Fig. 1, I erected at Bishop Creek. With all ordinary care in placing the concrete in the form, there was a weakness in the projecting slabs A. Should the concrete be too wet, the fine material is apt to gravitate toward the outer walls of the structure and will seal off. Continual vibrations may in time break off the projecting pieces.

I believe this form of mortar structure is weak where it should be strong, and am not surprised at reports from the Rand that the 2000-lb. stamp foundations have been found structurally weak.

The Nevada Hills form requires that the bolt holes in the mortar base be staggered to pass to opposing sides of the block. The form has four bolts on one side and three on the other. It is a good type of construction; all the concrete is used to withstand the pull on the bolts, and a broken bolt may either be taken out upward or downward.

The form of construction adopted at the new mill of the Aurora Consolidated, in Nevada, for 1550-lb. stamps, was, I believe, first recommended by myself. The type has been adopted at the Hollinger mill at Porcupine and the Iola Mill in North Carolina. My original design included a casting in the tunnel roof, into which were screwed the pipes through which the hold-down bolts pass so that there would be no trouble in keeping the pipes in alignment while tamping the concrete. A 6x8 or 4x12 timber extended the whole length of the mortar, or both mortars if there be two, the bolts passing through this timber.

There is a choice then between the Nevada Hills or Aurora types, both simple and efficient. I am rather inclined to the Aurora type as being more compact and requiring the whole mass to give away before any of it can break off. In the Nevada Hills type there is a chance of the corners breaking off or of a split extending through all the bolt holes on one side and so splitting off that side.

The sketch, Fig. 2, shows the Aurora form with concrete walls, designed for a hill-side structure. The ore-bin retaining wall and front wall may be built of rocks faced with, say 12 in. of concrete. Any dripping water or pulp will collect in the cellar about the mortar block.

As far as the cost of constructing these forms of mortar blocks is concerned, the City Deep type is the most expensive and difficult to make, while the other two are about equal. The hold-down bolts for the battery-post shoes are attended to in the same manner as the mortar bolts. The battery-post shoes must also provide for replaceable bolts between it and the battery post. These are no longer an experiment. We then have replaceable bolts in all our battery structure which is necessary with heavy stamps dropping at the maximum rate.

There may be those who, hearing of failures of concrete mortar structures, still doubt the advisability of this form of construction. Given a solid foundation, however, a good quality of cement, good sharp sand and rock, a fairly rich mixture of concrete with or without reinforcements, a mortar block of either the two forms recommended will withstand all the strains of a heavy battery of stamps.



# The Cost of Doing Things

## Nevada Hills

An analysis of the 1913 annual report of the Nevada Hills Mining Co., Fairview, Nev., shows a balance of receipts amounting to \$154,661 after deducting all expenditures. This figure is arrived at in the following manner; at the end of 1912 the balance of quick assets was \$32,662 and at the end of 1913, \$187,323, including unearned insurance but not including securities received. As no dividends were paid the difference, \$154,661, is the actual balance over expenditures during the year. Receipts totaled \$514,579 making actual expenditures \$359,918 or about \$8.56 per ton of ore.

The cost figures given in the annual report show the total cost to be \$7.955 per ton, made up as follows:

Mining:			
Development .....	\$1.354		
Stoping .....	2.447		
			\$3.801
Milling:			
Labor and assaying.....	\$1.080		
Supplies .....	1.225		
Power .....	0.534		
			2.839
Marketing:			
Concentrates .....	\$0.408		
Cyanide bullion.....	0.187		
Slag .....	0.003		
			0.598
General:			
Administration, etc.....	\$0.687		
Interest .....	0.046		
Property tax .....	0.050		
Bullion tax.....	0.012		
			0.795
Current construction charged to operations.....	0.021		
			0.021
Total operating expense.....	\$8.054		
Less miscellaneous earnings.....	0.099		
			0.099
Net cost reported.....			\$7.955
(Depreciation not included in these figures.)			

The average grade of the ore was \$13.78 per ton of which \$1.60 was lost in tailings, giving a mill recovery of 88.4%. Development work consisted of 2776 ft. of drifts and crosscuts at \$6.09 per ft., 2355 ft. of raises at \$4.94 per ft., 55 ft. of winzes at \$10.77 per ft.; 153 ft. of shaft, from 701 ft. to 854 ft., at \$62.04 per ft.; and 903 ft. of diamond drilling at \$2.58 per ft. of hole. Including ore and waste 60,829 tons were mined. Although the 1913 tonnage exceeded that of 1912 by 11,935 tons, the average grade of the ore fell \$13 per ton or about 48.5%. Plant depreciation amounting to \$195,000 was charged in addition to the operating expenses reported.

## Road Construction Costs

The cost of constructing two roads in a Southwestern mining district are here given. The first was 3290 ft. long, almost entirely a side-hill cut, carried at a uniform grade of 15% for about 2000 ft. and about 10% for the remaining 1290 ft. The average slope of the hill was 28°. The road was single track only. It was cut through soil, decomposed granite, and decomposed graywackes for the most part. There was one turn, however, which for about 60 ft. necessitated drilling and blasting fresh granite, the face being about 8 ft. high, and for 40 ft. required the construction of a dry wall 20 ft. high. Otherwise there was little drilling and blasting required. The work was done by Mexicans at \$2.50 per day under an

American boss. The cost of explosives was \$37, the labor cost was \$1833. The cost per foot worked out 57c. approximately.

The second road was 1012 ft. long with an average grade of 20%. It was also chiefly a side-hill cut in soil and fresh graywacke, but for part of its length was built of waste from a mine dump near-by, by filling in behind a dry wall of the same material. The explosives cost \$12, the labor \$584, a cost per ft. of 59c. approximately.

## Cost of Milling at Hollinger

The report of the Hollinger Gold Mines, Ltd., for 1913, shows an improvement in milling costs during the year. The capacity of the mill was gradually raised to 500 tons daily and extensions are projected which will raise it to 650 tons. About \$14,000 was spent in mill alterations during the year, and this was all absorbed in operating costs. An extraction of over 96% is obtained; the cost and mill data being shown in the accom-

### MILLING RECORD

	Hollinger	Acme	Total
Tons of ore milled.....	138,291	1840	140,131
Average value per ton.....	\$18.56	\$12.49	
Total values sent to mill.....	\$2,566,414.59	\$22,978.17	\$2,589,392.76
Average tons per day.....			383.92
Per cent. of possible time run.....			86.3
Average tons per 24 hours of running time.....			444.87
Stamp duty tons per 24 hours of running time.....			11.51
Values lost in tailings.....			\$101,370.18
Values recovered.....			\$2,488,022.58
Total values per ton in tailings.....			\$0.723
Per cent. of total gold extracted.....			96.085
Cyanide consumed per ton of ore.....			0.461 lb.
Lime consumed per ton of ore.....			2.422 lb.
Zinc consumed per ton of ore.....			0.663 lb.
Lead acetate per ton of ore.....			0.0065 lb.
Tons of solution precipitated per ton of ore.....			3.164
Zinc added per ton of solution.....			0.209
Average value of pregnant solution.....			\$5.612

### DISTRIBUTION OF MILLING COSTS, HOLLINGER MINES, 1913

Account	Labor	Stores	Total	Per Ton Ore Milled
General milling charges.....	\$6,068.26	\$4,940.90	\$11,009.16	\$0.081
Superintendence.....	9,110.86		9,110.86	0.066
Tailing disposal.....	1,103.60	1,011.15	2,114.75	0.015
Heating.....	2,345.60	3,128.78	5,474.38	0.039
Lighting.....	457.62	1,790.42	2,248.04	0.016
Mill power plant.....	267.05	167.30	434.35	0.003
Sampling.....	554.26	23.42	577.68	0.004
Coarse crushing.....	5,337.74	5,484.21	10,821.95	0.078
Conveying.....	4,318.18	2,898.16	7,216.34	0.051
Stamping.....	9,144.61	13,175.78	22,320.39	0.159
Class and tube milling.....	6,427.24	23,835.23	30,262.47	0.219
Concentration.....	5,550.71	3,769.88	9,320.59	0.068
Handling concentrates.....	1,131.70	1,397.10	2,528.80	0.018
Retreating concentrates.....	2,843.19	2,929.62	5,772.81	0.041
Handling pulp.....	1,716.76	2,765.14	4,481.90	0.032
Thickening.....	2,297.83	1,799.13	4,096.96	0.29
Agitation.....	3,858.32	1,061.58	5,519.90	0.039
Filtration.....	11,965.01	9,158.77	21,123.78	0.151
Neutralization.....	913.13	1,710.12	2,623.25	0.019
Clarifying and precipitation.....	2,218.43	10,434.25	12,652.68	0.091
Smelting and reeling.....	7,413.38	10,474.88	17,888.26	0.120
Pumping solutions.....	1,542.68	1,795.06	3,337.74	0.024
Cyanide.....	44.43	10,750.63	10,795.06	0.078
Cleaning up mill.....	5,724.28	62.40	5,786.68	0.041
Alterations to plant.....	6,292.83	8,475.08	14,767.91	0.105
Assaying.....	1,739.72	994.41	2,734.13	0.020
Watchman.....	619.10	1.50	620.60	0.004
Acid washing.....	130.26	728.84	859.10	0.006
Shoveling in bins.....	837.30		837.30	0.006
Stables.....	60.71	192.44	253.15	0.002
Shops.....	144.50	286.14	430.64	0.003
	\$102,179.29	\$125,842.32	\$228,021.61	\$1628
Less treatment charges on Acme Gold Mine Ore—1840 tons at \$3.....			5,520.00	
			\$222,501.61	\$1.609

panying table. Besides the Hollinger ore treated, a limited amount was milled for the Acme Gold Mines, Ltd., at a charge of \$3 per ton.

### Hollinger Gold Mines

The Hollinger Gold Mines, Poreupine, Ont., reports for year ended Dec. 31, 1913, receipts for gold and silver produced, \$2,465,978; rentals, \$3030; interest and discount, \$2265; total, \$2,471,273. Total operating costs were \$843,160; plant depreciation, \$105,571; development work written off, \$15,701; making a total cost of \$964,612. Net profit, according to these figures, was \$1,506,661 for the year. The balance sheet shows quick assets on hand amounting to \$510,463 over current liabilities after payment of \$1,170,000 in dividends. The following statistics are given:

Ore milled in 1912	45,195 tons yielding	\$ 933,682
Ore milled in 1913	138,291 tons yielding	2,466,220
Total to date		183,486 tons yielding
Average value of ore sent to mill in 1913		\$18.56 per ton
Average loss in tailings		\$0.723 per ton

Distribution of Costs		Per Ton Ore Milled
General charges		\$0.220
Strike expense		0.225
Administration and management		0.332
Taxes		0.060
Insurance		0.121
Clearing surface, roads, etc.		0.028
Operating camp		0.167
Operating boarding house		0.114
Mining:		
Explorations		0.094
Development		1.033
Production		1.961
Prospecting		0.001
Milling:		
Operations		1.522
Alterations		0.106
Alterations to plant		0.025
Marketing bullion		0.082
Fire protection		0.018
Total		\$6.110
Less charge to Acme Gold Mines		0.014
Depreciation: Plant		\$6.096
Development		0.765
		0.114
Total costs per ton of ore milled		\$6.975

Details of Mining Costs		Per Ton Ore Milled	Per Ton Rock Hoisted
General mining charges		\$0.040	\$0.037
Superintendence		0.081	0.078
Diamond drilling, 2651 ft. @ \$1.84		0.035	0.032
Crosscutting, 948 ft. @ \$9.85		0.066	0.062
Shafts, 368 ft. @ \$14.70		0.038	0.036
Drifts, 4149 ft. @ \$12.60		0.373	0.345
Raises, 334 ft. @ \$12.30		0.029	0.027
Winzes, 212 ft. @ \$26.70		0.040	0.037
Timbering shafts, winzes and raises		0.047	0.043
Stoping		0.985	0.900
Timbering drifts and stopes		0.219	0.202
Scaling		0.015	0.009
Tracklaying		0.024	0.022
Tramming		0.383	0.354
Pipe fitting underground		0.037	0.035
Mine drainage		0.052	0.048
Hoisting		0.196	0.181
Landing and dumping		0.057	0.053
Drill repairs		0.088	0.081
Sharpening steel		0.125	0.115
Collecting steel		0.051	0.047
Sampling		0.032	0.030
Assaying		0.015	0.015
Surveying		0.010	0.009
Change house		0.007	0.006
Mine lighting		0.002	0.002
Handling explosives		0.038	0.035
Shaft stations		0.003	0.003
Handling waste		0.001	0.001
Total, including cost of mining 1840 tons of Acme Gold Mines' ore		\$3.089	\$2.845

The above costs are for mining 138,148 tons of ore, from the following depths: 77,583 tons above 100 ft.; 40,835 tons above 200 ft., 15,782 tons above 300 ft., 3160 tons above 425 ft., and 788 tons below 425 ft. Development work furnished 37,128 tons, or approximately 27% of the ore tonnage.

The report devoted quite a little space to accidents, a summary of which follows. There were three fatalities: One from being entangled in a revolving shaft and two

from a premature explosion of dynamite while lighting a round of holes. Minor accidents consisted of five from setting up and taking down machines causing a loss of 26 days to the injured; nine were struck by falling rock, resulting in a total disablement of 86 days; six were injured by mine cars with a total loss of 70 days; 10 were struck by falling drills, crowbars, etc., causing a loss of 69 days; in one accident, caused by the dropping of the cage, three men were each disabled for three days. There were six injured by falls from scaffolds, etc., resulting in a total disablement of 56 days.

#### LABOR EFFICIENCY

Four-Week Period Ended	Men Employed At Mill and General Work		Tons Hoisted		Tons of Ore Milled	Tons per Man Under-Mill and General	Tons per Man Mine.	Ft. of Development Work for Period
	In Mine	Work	Ore	Waste				
Jan. 28	191	200	35,867	175	5,415	1.129	0.494	204
Feb. 25	234	211	9,201	188	9,240	1.130	0.742	330
Mar. 25	257	233	10,410	346	10,681	1.433	0.778	387
Apr. 22	231	231	11,047	384	11,357	1.767	0.876	161
May 20	178	193	6,596	100	6,550	1.344	0.631	169
June 17	208	196	12,010	674	11,867	2.178	1.049	301
July 15	207	158	10,095	1184	10,056	1.946	0.984	486
Aug. 12	226	161	11,802	2046	11,654	2.188	1.076	610
Sept. 9	240	162	12,396	1831	12,264	2.177	1.089	715
Oct. 7	252	171	11,594	1218	11,850	1.816	1.000	758
Nov. 4	254	175	13,210	1153	13,400	2.020	1.116	629
Dec. 2	263	162	12,970	1258	13,140	1.932	1.104	587
Dec. 31	268	155	12,790	987	12,657	1.904	1.108	684

The ore reserves are estimated to contain 845,300 tons of ore, averaging \$13.71 per ton. In addition to this ore, which is stated to be proven ore, there is estimated to be a possibility of 475,800 tons, averaging about \$12.50 per ton. The report is full of details and the stockholders are to be congratulated for having more than the usual amount of information given to them.

### Cyaniding vs. Concentration at Cobalt

The reasons which led to the construction of the low-grade mill of the Nipissing Mining Co., Ltd., Cobalt, Ontario, are described by James Johnson in an article in Bull. A. I. M. E., January, 1914. The results obtained by amalgamation and cyanide treatment in the high-grade mill encouraged the attempt to treat low-grade material by cyanide alone. The cost of such a mill, for treating 200 tons per day, extracting 90% at an expense of \$3 per ton, was estimated at \$250,000. The probable comparison between such a mill and a concentrating mill is given in the accompanying table.

#### COMPARISON OF MILLS TREATING 200 TONS PER DAY

Corrected pulp assay	32.09 oz. Ag	
Concentration mill to give 80% extraction.	Approximate cost \$160,000.	
80% x 32.09 oz. = 25.67 oz. @ \$0.52 =		\$13.35
Working costs		\$1.25
Marketing concentrates, 10%		1.33
Difference between corrected and commercial assay on concentrate = 2%		0.27
Profit per ton		\$10.50
Cyanide mill to give 90% extraction.	Approximate cost \$250,000.	
90% x 32.09 oz. = 28.88 oz. @ \$0.52, +0.3c. increase price in marketing =		\$15.16
Working costs		\$3.00
Excess in bullion		0.07
(\$3.50 per cwt.)		3.07
Profit per ton		\$12.09
Profit in favor of cyanide mill, per ton milled		\$1.59

Based on these figures the cyanide mill would return its extra cost after having treated 56,600 tons, a run of 283 days, provided the expectations calculated upon were realized. That they have been is shown by the accompanying data, showing the results actually obtained.

#### DATA OF NIPISSING LOW-GRADE MILL

Cost of mine construction	\$254,839.52
Extraction on 26-oz. ore	92 to 93%
Milling cost, per ton, under	\$3
Tons treated per day	244



# Mining & Metallurgical Machinery

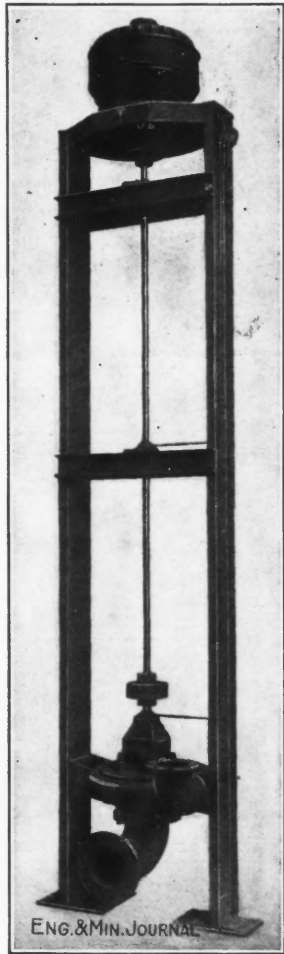
## Vertical Centrifugal Pump

A new line of vertical centrifugal pumps has been placed on the market by the Lea Equipment Co., of Philadelphia, Penn. The pumps are designed for medium lifts, up to 100 ft. and for operation by low-speed motors. They are of the single-suction volute type, with in-closed impellers. The suction head is made detachable and a detachable flange supports the stuffing-box and thrust bearing. This design gives easy access to the impeller wheel. The casing is made of cast iron or bronze is fitted with removable bronze rings to protect it against wear from the impeller. These rings also increase the efficiency of the pump by reducing the slip.

The thrust bearing is of the radial ball type, and is usually carried on the top of casing whenever the pump is installed in a dry pit. When the pump is submerged, the bearing is carried on the upper end of the vertical shaft directly under the motor base to insure its proper lubrication. The photograph shows the bearings provided with side-feed lubrication, but they are also designed for forced lubrication, a desirable feature under certain conditions.

The pump with its guide bearings and motor base is assembled in a rigid frame of channel iron, rendering it self-contained and portable.

The pumps are manufactured in sizes from 1½ in. up to 10 in., and with capacities ranging from 50 to 2000 gal. per minute.



LEA PUMP AND MOTOR IN FRAME

## Gasoline-Air Rock Drill

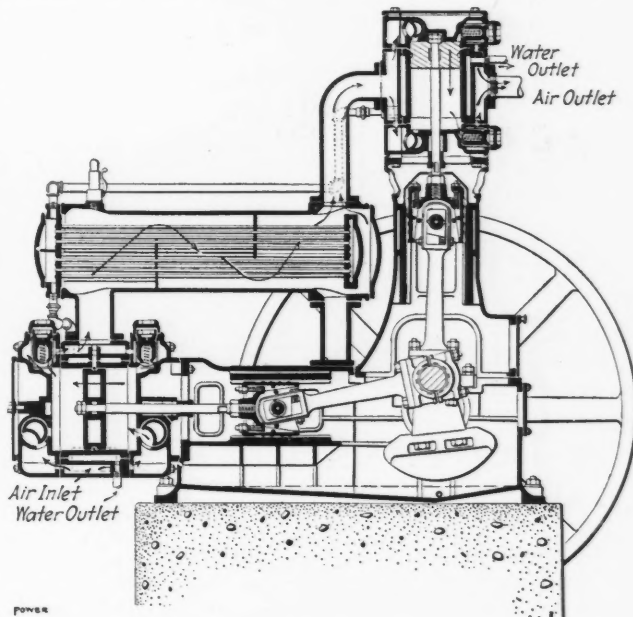
A recent modification of the Temple-Ingersoll electric drill employs a gasoline engine instead of an electric motor to drive the pulsator. Since the action of the pulsator and the drill is well known, interest in this new machine centers in the engine. This is mounted on the same truck with the pulsator and drives the latter through gearing. It is of the jump-spark type, the spark being obtained from dry cells. The circulating water is

had from any convenient receptacle placed near the equipment. The splash system of lubrication is employed for the piston and crank-pin bearing and grease cups lubricate the main bearings. A gasoline supply tank of 1¼ gal. capacity surmounts the engine. The fuel consumption under load is said to be about two quarts of gasoline per hour, so that the average daily fuel consumption would be approximately three or four gallons.

The field of this machine is, of course, limited. It is quite unsuitable for underground work but should have a certain usefulness in open-pit mining and in excavation for construction. It offers a great advantage over the electric motor type of drive in being entirely self-contained, in fact a portable power plant in itself.

## Two-Stage Power-Driven Angle Compressor

While angle-compound engines have been used for many years where high speed, freedom from vibration and close economy were necessary, and while some compressors of large capacity have followed that type of de-



SECTION THROUGH THE COMPRESSOR

sign, it is probable that the compressor recently brought out by the Sullivan Machinery Co., is the only angle machine now offered in ordinary small sizes.

The manner of construction is pretty clearly set out in the illustration. The low-pressure cylinder is horizontal, the high-pressure, vertical. The vertical and horizontal frames are similar in design, of the Tangye pattern with bored guides. A heavy cast-iron counterweight is bolted to each crankcheek, neutralizing the inertia of both sets of reciprocating parts. The crankshaft extends at one side to carry the driving pulley, its end being sup-

ported in an outboard bearing. If desired, a direct motor-drive may be used, in which case a flywheel is substituted for the pulley, and the crankshaft built longer.

The machine has rotary inlet valves and poppet discharge. The intercooler uses aluminum tubes; it is supported next the vertical cylinder by a hollow leg into which any accumulation of water or air from the air space will drain, and from which it may be blown; a pop safety-valve is inserted in the top. The lubrication system is well developed. The bottom of the horizontal frame forms an oil reservoir. From here, a small plunger pump driven from the air-valve connections delivers oil to the top of a standpipe whence the oil flows through sight-feed connections to the crank and cross-head bearings and drains back to the frame reservoir. An overflow from the standpipe to the frame reservoir takes care of the excess oil which the pump is designed to supply. The air cylinder and inlet valves are supplied by a separate pump, also driven by the valve gear; the valve-gear joints carry grease caps; the outboard bearing is independently lubricated from a well below the bearing to which oil is delivered by ring oilers.

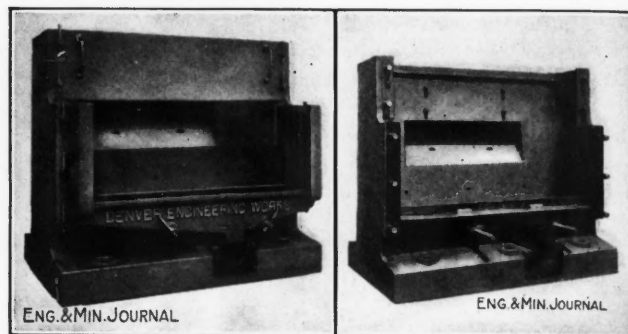
The unloader is shown attached near the bottom of the low-pressure cylinder. It is designed to shut off incoming air when the receiver pressure uses above the desired pressure, thus allowing the machine to operate under no load. When the pressure again drops, the valve again permits air to enter.

efficiency. The momentum of the moving parts increases as the square of the rotative speed, so that high speeds increase vibration troubles tremendously. In this design, the disturbing influences of the horizontal and the vertical members tend to offset each other.

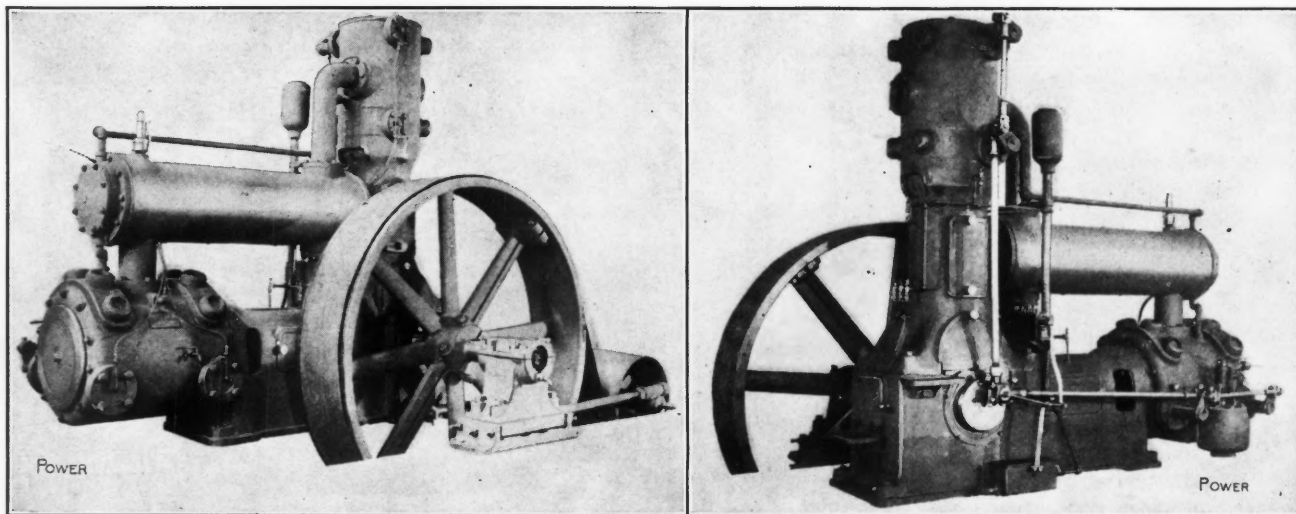
✽

### New Open-Front Mortar

A new mortar which was designed by the late Godfrey D. Doveton, and installed by him in the new Cinco Minas mill, at Magdalena, Jalisco, Mexico, is shown in the accompanying engraving. One view shows the front entirely removed, and the other shows the front in place, but without the screen. By this construction the whole



NEW OPEN-FRONT MORTAR



TWO VIEWS OF THE ANGLE COMPRESSOR SHOWING RELATION OF CYLINDERS, INTERCOOLER AND CRANKSHAFT

It is claimed for this compressor that it delivers more actual compressed air than any other design of power-operated compressor per unit of power, attendance, maintenance, supplies, floor space, and cost of installation; in other words, it has the highest commercial efficiency. Its advantages are various. A great saving in floor space is obtained over other types; accompanying this is the possibility of using a smaller and lighter foundation; the drive is extremely flexible, including direct connection to waterwheel or motor, belt drive from a distance or from near-by with a tightener pulley; a single crankpin takes the place of the two eccentrics of the duplex type. The most noteworthy feature, however, is the reduction of vibration and friction by means of close balancing of the working parts, thus permitting a higher speed and greater capacity per unit of size, and also increasing the

of the mortar is available for work, and there need be no hoisting of stamp stems, bosses, etc., over the mortar, nor inconvenient working inside a closed box.

Both back and front are straight. An opening is cast in the base of the mortar from back to front, and terminates in a short spout which receives the pulp from the cast-iron launder above it. This opening carries the undersize from a screen, placed between the feeder and the mortar, and it joins the discharge from the launder, relieving the stamps and increasing the mortar capacity. There is a vertical splashboard in front of the mortar, completely hiding the screen. The feed opening is larger than ordinary and the corners inside the mortar are decidedly rounded. Six 2¼-in. foundation bolts are used instead of the usual eight 1½-in. rods. The mortar is made by the Denver Engineering Works, of Denver.



# The United States Steel Corporation

*SYNOPSIS—Summary of the operations of the company during 1913. Its gross earnings were nearly \$800,000,000, and it handled nearly half the steel business of the country. About 26% of its gross earnings were paid for labor.*

The operations of this company are so extensive and cover so large a field, and its annual report goes so extensively into detail, that it is possible to give here only a brief and condensed summary, but is believed that will show clearly the operations and condition of the company.

The balance sheet as of Dec. 31, 1913, is as follows, condensed as much as possible:

Stock.....	\$869,173,142
Bonded and debenture debt.....	627,097,377
Obligations of subsidiary companies.....	9,865,809
Current liabilities.....	58,577,061
Reserve funds.....	79,074,506
Appropriated surplus.....	5,000,000
Undivided surplus.....	151,798,429
<b>Total liabilities.....</b>	<b>\$1,500,586,323</b>
Property accounts.....	\$1,465,498,637
Defined charges.....	7,455,381
Investments.....	3,407,183
Sinking and reserve fund assets.....	20,467,344
Current assets.....	303,757,734
<b>Total assets.....</b>	<b>\$1,800,586,323</b>

The stock includes \$508,302,500 common, \$360,281,100 preferred and \$589,542 subsidiary companies' stocks outstanding.

The volume of business done by all companies during the year, as represented by their combined gross sales and earnings, equaled the sum of \$796,894,299, as compared with a total of \$745,505,515 in the preceding year. This amount represents the aggregate gross value of the commercial transactions conducted by the several subsidiary companies, and includes sales made between the subsidiary companies and the gross receipts of the transportation companies.

The following is a statement of the gross sales and earnings classified by operating groups. Gross sales of products are included on basis of f.o.b. mill values: Gross sales by manufacturing, iron ore, coal and coke companies:

To customers outside of U. S. steel organization.....	\$518,999,605
Inter-company sales (sales between subsidiary companies).....	211,910,441
Gross earnings and receipts of transportation companies.....	57,726,430
Miscellaneous companies.....	8,257,823
<b>Total.....</b>	<b>\$796,894,299</b>
Operating charges.....	647,052,583
<b>Net balance.....</b>	<b>\$149,841,716</b>
Add interest and sundry gains.....	4,352,642
<b>Total.....</b>	<b>\$154,194,358</b>
Profits of subsidiary companies not yet realized.....	7,027,741
<b>Net earnings.....</b>	<b>\$147,166,617</b>

The expenses are divided as follows: Selling and general expenses, \$19,587,315; taxes, \$13,225,882; commercial discounts and interest, \$3,855,874; the balance being operating and producing expenses and costs.

No special appropriations were made in 1912. In 1913 the sum of \$15,000,000 was appropriated for additional property and construction, leaving \$15,582,184 to be carried to surplus.

The general income account for two years past is as follows, in condensed form:

	1912	1913	Change
Net earnings, as above.....	\$117,926,402	\$147,166,617	I. \$29,240,215
Subsidiary companies charges.....	\$9,751,729	\$9,985,272	I. \$233,543
Depreciation funds.....	22,734,366	23,972,376	I. 1,238,010
Sinking funds.....	7,597,384	7,884,277	I. 290,893
Interest on bonds.....	22,817,471	22,532,691	D. 284,780
Premium on bonds paid.....	767,705	783,318	I. 15,613
Sundry adjustments.....	17,698	787,697	I. 769,999
<b>Total charges.....</b>	<b>\$63,686,353</b>	<b>\$65,543,631</b>	<b>I. \$2,263,278</b>
<b>Surplus.....</b>	<b>\$54,240,049</b>	<b>\$81,216,986</b>	<b>I. \$26,976,937</b>
Common stock, 5%.....	\$25,415,125	\$25,415,125	.....
Preferred, 7%.....	25,219,677	25,219,677	.....
<b>Total dividends.....</b>	<b>\$50,634,802</b>	<b>\$50,634,802</b>	.....
<b>Undivided balance.....</b>	<b>\$3,665,247</b>	<b>\$30,582,184</b>	<b>I. \$26,976,937</b>

The expenditures made by all companies during the year 1913 for maintenance and renewals, including the relining of blast furnaces, and for extraordinary replacements, were as follows: Ordinary maintenance and repairs, \$52,551,630; extraordinary replacements, \$7,391,340; total, \$59,942,970. The entire amount of the foregoing expenditures was charged to current operating expenses and to depreciation and replacement funds reserved from earnings. The sum was an increase of \$11,194,533 over 1912. The aggregate amount of charges to and allowances from gross earnings during the year to cover deterioration arising from wear and tear of improvements, exhaustion of minerals and for obsolescence, was \$84,237,608, an increase of \$8,811,754 over the previous year.

The net book valuation of the inventories of manufacturing and operating materials and supplies and semi-finished and finished products, including net advances on contract work, etc., for all of the subsidiary companies equaled at Dec. 31, 1913, the sum of \$167,634,791, in comparison with \$152,412,254 at close of the preceding year, an increase of \$15,222,537. The increases during the year were principally in iron ores, pig iron, fuel, semi-finished steel and finished products for sale.

## PRODUCTION

Notwithstanding the total tonnage of shipments was substantially the same in 1913 as in the preceding year, the total earnings (exclusive of charges for interest on subsidiary companies' securities outstanding) increased \$29,240,215, or 24.8%. This increase is attributable principally to higher average prices having been received in 1913. In 1912 the prices received for the great bulk of the output were, however, on a very low level. In 1913 the average price received for the entire tonnage of rolled and other finished products shipped was, in respect of the domestic business, \$2.40 higher per ton than the similar average price received in 1912; and for the export business, \$4.16 more per ton. Better prices also were received for cement and pig iron. The reduction in export shipments in 1913 and 1912 arose in part from a slackening in the demand, due principally to the money stringency in foreign markets during 1913, and in part to the inability of the mills to furnish, when required, sufficient material for export in the first six months of the year because of the demands of domestic consumers. The export shipments to Mexico were also curtailed owing to the unsettled condition of affairs in that country. The order books of the subsidiary companies at the close of business, Dec. 31, 1913, showed unfilled orders amounting to 4,282,108 tons.

A considerable part of this tonnage covered contract requirements extending through the first six months of 1914 and, therefore, only in part were the orders included in the total available for immediate rolling and shipping. Contemporaneously with the sharp falling off in the mid-summer of 1913 of new business offering, there was a weakening in prices on the majority of the classes of products. This decline in prices steadily continued until the early part of 1914, when there was a moderate reaction.

The production of the subsidiary companies for the year 1913, compared with the year 1912, was as follows:

Products	1912	1913
<b>Iron Ore Mined</b>		
In Lake Superior Region		
Marquette range	551,575	583,266
Menominee range	995,401	980,346
Gogebic range	1,497,950	1,871,700
Vermilion range	1,301,663	1,301,163
Missabe range	20,001,953	21,634,206
In Southern Region		
Tennessee Coal, Iron & R. R. Co.'s Mines	2,079,907	2,367,770
Total	26,428,449	28,738,451
<b>Coke Manufactured</b>		
In bee-hive ovens	11,554,840	11,062,138
In by-product ovens	5,164,547	5,601,342
Total	16,719,387	16,663,480
Coal mined, not including that used in making coke	5,905,153	6,705,381
Limestone quarried	6,124,541	6,338,509
<b>Blast Furnace Production</b>		
Pig iron	13,990,329	13,879,706
Spiegel	53,829	65,236
Ferro-manganese and silicon	142,006	135,788
Total	14,186,164	14,080,730
<b>Steel Ingot Production</b>		
Bessemer ingots	6,643,147	6,131,809
Openhearth ingots	10,258,076	10,524,552
Total	16,901,223	16,656,361
<b>Rolled and Other Finished Steel Products for Sale</b>		
Steel rails (heavy and light tee and girder)	1,857,407	1,927,745
Blooms, billets, slabs, sheet and tinplate bars	1,103,752	842,175
Plates	1,076,308	1,108,147
Heavy structural shapes	898,537	998,624
Merchant steel, bars, hoops, bands, skelp, etc.	1,910,512	2,024,192
Tubing and pipe	1,111,138	1,186,740
Wire rods	196,720	174,478
Wire and products of wire	1,629,717	1,432,182
Sheets (black and galvanized) and tin-plate	1,508,607	1,280,537
Finished structural work	599,301	652,363
Angle splice bars and all other rail joints	192,488	256,676
Spikes, bolts, nuts and rivets	83,426	86,465
Axles	142,367	159,075
Steel car wheels	65,931	93,375
Sundry steel and iron products	130,408	152,064
Total	12,506,619	12,374,838
Spelter	31,318	30,424
Sulphate of iron	35,215	33,829
Universal portland cement, bbl.	10,114,500	11,197,000

The shipments of all classes of products to customers outside of the organization in 1913 was as follows, in tons:

	Domestic	Foreign	Total
Rolled steel and other finished products	10,412,430	1,756,328	12,168,758
Pig iron, ingots and scrap	451,980	56,104	508,084
Iron ore, coal and coke	1,617,169		1,617,169
Sundry materials and by-products	88,844	640	89,484
Total, tons	12,570,423	1,813,072	14,383,495
Cement, bbl.	10,382,883		10,382,883

#### GENERAL REMARKS

The total charges for the year for taxes levied against the Corporation and its subsidiary companies, including the Federal income tax for 1913, was \$13,225,882, an increase of \$3,385,511 over the preceding year. The greater part of this increase was in the state and local taxes levied against the iron ore and transportation properties.

The expenditures and charges incurred during the year by the Corporation and the subsidiary companies for additional property, new plants, extensions and construction, less credits for property sold and for stripping and development work at mines, were: For the Gary, Ind., properties, \$2,960,125; for the new Minnesota steel plant, at Duluth, Minn., and the railroad connecting the same with trunk lines, \$5,912,027; for Tennessee Coal, Iron & R.R. Co. extensions, \$1,274,441; for acquirement of the

fee title to various iron-ore properties previously held under royalty contracts, \$11,670,182; for all other properties and extensions, including net credit account of mine stripping and development operations, \$20,182,323; total, \$41,999,998.

The charge for acquirement of the fee title to iron-ore properties previously held by the subsidiary companies under royalty contracts, was based in part on commuting to their present-day value certain of the royalties which would have become payable under the contracts; and in part on the par value of certain of the royalties, issuing, however, in settlement for the amount thereof non-interest-bearing purchase money obligations or notes payable in installments during the period for which the contracts had yet to run. Of the total charged as above, \$2,283,678 only has been paid in cash, and the balance, \$9,386,504, is covered by purchase-money notes of the Oliver Iron Mining Co. guaranteed by the United States Steel Corporation. Of these notes, \$1,240,404 bear 4% interest per annum, and \$8,146,100 are non-interest-bearing notes.

At the close of the year the amount unexpended on authorized appropriations for new plants, construction and extraordinary replacements, including iron-ore mine stripping program for 1914, was, approximately, \$26,000,000.

This total is largely made up of amounts to be expended in completing the new plants and work under construction as above described and for mine-stripping operations. During the year a total of \$16,807,366 of bonds, mortgages and purchase-money obligations of the Corporation and the subsidiary companies was paid off. Of this total \$8,342,000 were redeemed through the sinking funds of the mortgages securing the bonds retired. Bonds of subsidiary companies (largely car trusts) in the amount of \$375,000 were issued and sold during the year for account of outlays made for additions and betterments.

#### EMPLOYEES AND PAY-ROLL

The average number of employees in the service of all companies during the year 1913, in comparison with the year 1912, was as follows:

	1912	1913
Manufacturing properties	161,774	165,277
Coal and coke properties	24,394	24,996
Iron ore properties	12,597	13,789
Transportation properties	19,438	21,951
Miscellaneous properties	2,822	2,893
Total	221,025	228,906
Total salaries and wages paid	\$189,351,602	\$207,206,176
<b>Average Salary or Wage per Day:</b>		
All employes, exclusive of general administrative and selling force	\$2.68	\$2.85
Total employes, including general administrative and selling	2.75	2.92

The general advance in wages and salaries made to the larger proportion of the employees on Feb. 1, 1913, affected about 75% of the employees, the 25% not affected being the higher-paid earners and salaried employees. The increase was about 12½% in the case of employees receiving less than \$2 per day, and graduating downward from this percentage in respect of those receiving higher rates per day. The average increase in the entire pay-roll (including both employees whose rates of pay were and were not affected) arising from this advance in wages and salaries, was 6%, and the increased amount paid employees during 1913 because of this advance was \$12,000,000 approximately.



## Spelter Statistics for 1913

BY W. R. INGALLS

Revised and complete statistics of the zinc industry in the United States in 1913 are given in this article. The total production of spelter by ore-smelters in 1913 was 358,262 tons, of which about 8764 tons were derived from galvanizers' dross, skimmings, scrap, etc., and the remainder from ore. The production from dross, scrap, etc., was 7447 tons in 1912, 9930 tons in 1911 and 7793 tons in 1910. These data do not include the production of spelter by concerns which treat dross and scrap only, whose output amounts to about 16,000 tons per annum.

### PRODUCTION OF ZINC

States	(In tons of 2000 lb.)			
	By Ore Smelters			
	1910	1911	1912	1913
Colorado	6,564	7,477	8,860	8,637
Illinois	79,570	88,681	94,902	111,551
Missouri and Kansas	112,182	106,173	111,761	85,157
Oklahoma	34,760	46,333	76,837	83,230
East	43,989	47,172	56,278	69,687
Totals	277,065	295,836	348,638	358,262
By Dross and Scrap Smelters				
	1910	1911	1912	1913
	11,350	(a) 13,500	(a) 15,000	(a) 16,000
Total Production of Zinc				
	1910	1911	1912	1913
Ore smelters	277,065	295,836	348,638	358,262
Dross smelters (a)	11,350	13,500	15,000	16,000
Totals	288,415	309,336	363,638	374,262

(a) Estimated.

### RECEIPTS OF ZINC ORE

(In tons of 2000 lb. This table includes the receipts of ore by the smelters only and does not include the production of ore exported or what was taken by the manufacturers of zinc oxide.)

State	1910 (a)	1911 (a)	1912 (a)	1913
Arizona	7,568	6,895	11,937	9,347
Arkansas	190	860	1,567	1,500
California	(d)	3,754	6,639	6,796
Colorado	77,065	158,528	212,423	220,166
Idaho	10,248	9,667	19,482	31,835
Kentucky	179	575	947	441
Missouri-Kansas	289,913	268,500	289,177	280,000
Montana	33,514	56,593	34,034	91,257
Nevada	4,915	5,666	20,654	22,313
New Mexico	15,959	10,184	25,889	14,593
Oklahoma	1,640	8,750	4,325	23,500
Tennessee	2,775	3,439	6,635	8,297
Utah	27,318	19,933	24,539	27,073
Wisconsin (b)	51,383	71,565	90,762	89,662
Others	46,905	44,896	56,099	57,241
Totals	569,572	669,305	805,109	884,021
Mexico	29,198	28,596	29,436	19,965
Canada	11,795	2,356	9,707	6,012
Grand totals (c)	610,565	700,257	844,252	909,998

(a) Smelters' receipts; reports missing from three small smelters. (b) Including Illinois and Iowa. (c) In addition to the ore reported from Canada and Mexico, zinc smelters received a few thousand tons from Europe and Eastern Siberia in 1913. (d) Included in "Others."

The amount of the recovered spelter that should properly be counted statistically is uncertain. A good deal of scrap zinc is remelted in the manufacturing plants where it is made, e.g., in every rolling mill, and such remelted zinc should not, of course, appear in any statistical enumeration. On the other hand certain smelters buy and re-distill and subsequently sell as spelter, often of excellent quality, what was distinctly a waste product. This is obviously an addition to the new supply of spelter and should be recognized just as is that which the ore smelters recover from dross, skimmings, etc. In my estimate I have conformed to this reasoning.

Of the total spelter production of the ore-smelters in 1911, concerns using coal as fuel produced 119,989 tons, or about 40% of the total. In 1912 they produced 134,077 tons, which was only about 38% of the total. In

1913, their production was 231,346, or about 60% of the total.

In addition to the spelter production there was an output of 423 tons of commercial zinc dust in 1913, against 492 tons in 1912 and 254 tons in 1911. Two smelters are engaged in this business. The importations of zinc dust were about 2200 tons, against 2400 tons in 1912 and 1713 tons in 1911.

In 1910 there were produced 3398 tons of spelter in bond. In 1911 the production in this way was 9598 tons, in 1912 it was 10,879 tons, and in 1913, it was 5904 tons. The exports of bonded spelter are stated in an accompanying table.

### SPELTER PRODUCTION IN 1913 BY QUARTERS

(Reports of Ore Smelters Only)

District	(In tons of 2000 lb.)			
	I	II	III	IV
Illinois	27,924	28,523	26,118	28,986
Kansas-Missouri	22,006	23,820	19,204	20,127
Oklahoma	21,430	21,840	18,502	21,458
Others (a)	20,722	20,153	19,238	18,211
Totals	92,082	94,336	83,062	88,782

(a) With the exception of one plant in Colorado these are all Eastern works

There was a large increase in zinc-ore production in 1913, which in part was due, no doubt, to the stimulus of the high prices prevailing in the early part of the year, but even allowing for that, the increase was so large that it must cause a reconsideration of previously held ideas respecting a shortage of zinc ore. There was a large increase in the output of Butte, Mont., where milling difficulties were solved. Idaho and Oklahoma exhibited noteworthy gains. In Tennessee, where an important new mine was developed, there was only a small gain. Rather surprising was the falling off in New Mexico, where the successful milling of the Magdalena ore was supposed to have become an accomplished fact. Joplin, Leadville and the Wisconsin districts about held their own.

The statistics of zinc-ore production are based in the main upon reports from various smelters respecting the quantity of ore received by them and its origin. There are some discrepancies between the figures thus compiled and figures reported in other ways. Thus, the production of the Butte & Superior Co. was reported at about 103,000 tons, while the smelters reported receiving only 91,257 tons from Montana. Mr. Kennedy's figures for Wisconsin showed a great falling off in output in that state in 1913, but the smelters' figures show about the same total of ore received in 1913 as in the previous year.

In 1913, there were eight zinc smelters who produced sulphuric acid from blende, the Robert Lanyon Zinc & Acid Co. being an addition to the list. The statistics of the works of this class for the last three years are as follows:

### STATISTICS OF SPELTER-SULPHURIC ACID WORKS

	(In tons of 2000 lb.)			
	1910	1911	1912	1913
Ore received			287,205	364,741
Spelter produced	100,791	115,310	127,655	148,188
Sulphuric acid produced, basis 60°	202,000	252,192	262,555	305,167

As in the previous year the smelters who make sulphuric acid drew their main ore supply from the Joplin district and Wisconsin, but it is noteworthy that some of these smelters now use a good deal of Western ore. In 1911 they received 107,995 tons of blende from the Jop-

lin district and 71,168 tons from Wisconsin. In 1912 they obtained 117,806 tons from Joplin and 87,676 tons from Wisconsin. In 1913 they obtained 159,540 tons from the Joplin district and 84,495 tons from the Wisconsin district. Oklahoma and Kansas are reckoned with the Joplin district, and Iowa and Illinois with the Wisconsin district.

The total stock of spelter at smelters' works at the end of 1913 was 40,115 tons, against 4264 at the end of 1912, 9323 at the end of 1911 and 23,000 tons at the end of 1910. The deliveries into consumption are computed in the accompanying table.

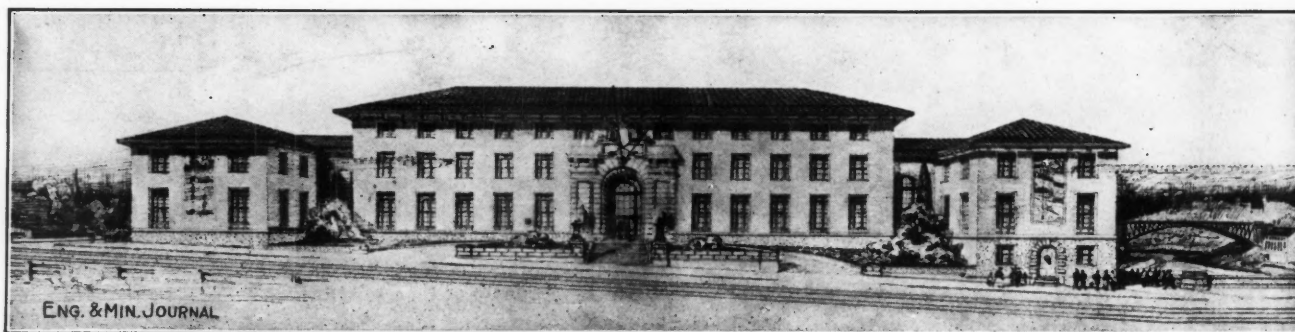
DELIVERIES INTO CONSUMPTION				
	1910	1911	1912	1913
Stock, Jan. 1.....	11,500	23,000	9,323	4,264
Production.....	288,415	309,336	363,638	374,262
Imports.....	3,452	1,637	11,115	6,100
<b>Totals.....</b>	<b>303,367</b>	<b>333,973</b>	<b>384,076</b>	<b>384,626</b>
Exports, domestic.....	3,989	6,872	6,634	7,782
Exports, foreign.....	4,468	11,270	8,700	
Stock, Dec. 31.....	23,000	9,323	4,264	40,115
Deliveries.....	271,892	316,508	364,488	

The stock of smelter at the end of 1913 was the largest of which we have record. Deliveries are computed by difference between (A) stocks, plus production, plus imports, and (B) exports plus stocks, but the ex-

## Experiment Station for the Bureau of Mines

Plans for the proposed \$500,000 experiment station of the United States Bureau of Mines, to be built in Pittsburgh, Penn., have been approved by the commission appointed by Congress for that purpose. The Government now owns the property and will erect a group of buildings designed for carrying on of mine safety work and other investigations in which the Bureau of Mines is interested. Congress a year ago authorized a new home for the Bureau of Mines, to cost \$500,000. A specific appropriation is now expected, so that construction work may begin.

The commission which has approved the plans consists of J. A. Holmes, D. C. Kingman, chief of engineers of the United States Army, and O. Wenderoth, supervising architect of the treasury. The State of Pennsylvania has appropriated \$25,000 for coöperation in establishing this experiment station and has appointed a state commission, consisting of James E. Roderick, chief mine inspector, Dean W. R. Crane, of the mining department, Pennsylvania State College, and W. H. Caverly. This latter commission has tentatively approved the plans.



PROPOSED BUREAU OF MINES' EXPERIMENT STATION AT PITTSBURGH

periences of 1912-13 show how futile it is to attempt to compute consumption in that way, and how important a part is played by the stocks in the yards of galvanizers and brass makers, the invisible supply. At the end of 1912 that invisible supply was large, no doubt; at the end of 1913 it was believed to be small. However, that was only surmise and the subsequent history of the market throws doubt upon it. Included in the stock reported at the end of 1913 was 615 tons of bonded smelter.

Another point that deserves note is the increasing production of spelter from dross and the decreasing exports of that material. In 1911, the exportation was 4246 tons; in 1912 it was 205 tons; and in 1913 it was only 28 tons. We estimate the product redistilled from dross, skimmings, etc. (by works treating this material only), at 13,500 tons in 1911, 15,000 tons in 1912 and 16,000 tons in 1913, and probably these figures are underestimates rather than overestimates. In taking a statistical view, this spelter must be added to the spelter obtained otherwise, it being sold in the same way and being just as good, indeed, it is often better than some of the virgin spelter.

■

**The President Has Withdrawn 45,720 acres in Southern California** believed to be valuable for their oil content. The reserve thus created includes over 2000 acres in the Sunset district 40 or 50 miles west of Bakersfield and nearly 44,000 acres in the Belridge-Lost Hills district. Both of these areas have been examined by geologists of the Geological Survey.

The buildings which will constitute the experiment station of the Bureau will form part of a group of edifices devoted to educational purposes. On one side, the bureau's buildings will face the structures of the Carnegie School of Technology. On another side is the Carnegie Institute, in which are the art gallery, museum and library. Nearby are the buildings of the University of Pittsburgh. The site consists of nearly 12 acres of land.

The group consists of three main buildings facing Forbes Street. The central building of the group, the mining building, will be three stories in height, flanked by two main buildings, one the mechanical and the other the chemical building. In the rear of these and inclosing a court will be the service building. Beyond the service building and spanning Panther Hollow, and thus connecting the Bureau of Mines buildings with the Carnegie school, will be two buildings, over the roofs of which will pass the roadway from Forbes Street to the Carnegie school buildings and Schenley Park.

Between the main group and the power and fuel group will be the entrance to a series of mine shafts. One of these will be used as an elevator to carry heavy material and passengers from the lower level to the upper; another will be for tests of hoisting ropes and similar mining appliances; another will be an entrance to tunnels extending under the buildings and in which mining experiments, such as fighting mine fires, will be conducted.



The portion of Panther Hollow above the power buildings will be arranged as a miners' field, the slopes of the ravine being utilized as an amphitheater which will accommodate 20,000 spectators who may assemble here to witness demonstrations and tests in mine rescue and first-aid.

The main or mining building will contain the administrative offices, and those of the mining force. The mechanical building will be for experiments and tests of mining machinery and appliances and the chemical building for investigation and analyses of fuels, explosives and various mineral substances.

The buildings now used by the Bureau of Mines at Pittsburgh were lent to the bureau by the War Department when the bureau was created. The War Department has suggested that it now needs these buildings.

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## The Flotation Litigation

LONDON CORRESPONDENCE

The decision of the appeal from the Australian Courts to the Privy Council in London was given on Mar. 6, in favor of the respondents, i.e. the Sulphide Corporation, as noted in the JOURNAL on Mar. 14.

The case was heard before five judges and their full judgment takes three columns of the daily press. It falls into two sections, as the Sulphide Corporation pleaded first, that the Elmore patents were invalid; and second, that if the Elmore patents were held to be valid, the Sulphide Corporation does not infringe them.

The patents quoted in the case prior to the Elmore patents of 1901 were Hayne's dated 1860, Everson's dated 1886, about which information was published in the "ENGINEERING AND MINING JOURNAL" in 1890 under the heading of "The Criley & Everson Oil Process" and the Robson & Crowder patent dated 1894. The court held that there was no anticipation of the Elmore patents and that the Elmore patents are valid.

Regarding infringement, the court held that as the Elmore patents claim that the separation of mineral substances is effected by the selective action of oil and the balance of expert evidence showed that the Sulphide Corporation's process relies on surface tension only, there is no infringement.

The portion of the judgment dealing with this question is of great interest, and is here published in full.

The real difficulty which their Lordships have to determine is whether the respondents, in the process of separation which they employ, entrap or coat and hold or carry the metallic particles in oil, using oil as the selective agent. The respondents deny that they in any way use the appellants' invention and say that their process is essentially distinct, and that its successful operation depends on the law of surface tension. It is not incumbent on the respondents to explain the law on which the success of their process depends. The Chief Judge in Equity has not found it necessary to decide whether the true explanation of the respondents' process is the law of surface tension, but states that he is inclined to think that the balance of evidence is in favor of the view of Professor Pollock. This view is very clearly expressed in an answer given by Professor Pollock to question 5610:

I think that the main fact that underlies the working of the defendants' process is that water in the presence of air wets the gangue material, but does not wet the metallic particles. That combined with another fact which may be stated in this way, that liquids behave as if they were contained in an elastic membrane which is always tending to contract, gives the result that if a bubble of air rising through the liquid meets a gangue particle the mutual forces are those of repulsion, whereas if it meets a metallic particle the metallic particle pierces the surface and the forces are such as to entrap the metallic particle on the air side of the liquid air surface.

Professor Pollock produced a drawing at the trial to illustrate his meaning, and much assistance was given to the Board by a drawing made and explained by the leading counsel for the respondents. The attention of their Lordships was directed to many other relevant passages in the evidence of professor Pollock, and to "Rayleigh on Forces," Vol. 3, p. 353. Whether Professor Pollock is right to the whole extent of the theory he expounds it is unnecessary for the Board to determine. The importance of Professor Pollock's evidence is that he shows that surface tension might account for the success of the respondents' process, to this extent displacing any inference that the addition of an acid to a mixture of oil and watery pulp in a process of separation necessarily implies the use of the invention of the appellants. Apart from any question of theory the respondents use oil in their process under conditions which make it almost impossible to entrap or coat and hold the metallic particles by the selective agency of oil. The respondents use a thin oil at a temperature of 120° F., the quantity is minute, not more than 2 lb. or 3 lb. per ton of ore, or about two or three pints of oil to 10,000 pints of water; the resulting concentrate is practically free from oil and no mechanical contrivance to separate the oil from the metallic particles is required or used; the residue of the first concentration is further treated without any further addition of oil.

There is no doubt a difference in the views of the respective experts whose standing and experience entitle them to great weight and authority; but in deciding between these views their Lordships accept the evidence of Professor Pollock to be found in question 5780 and the following questions. This evidence may be summarized as follows: Professor Pollock is referred to his earlier evidence and states that he does not think that the small quantity of oil introduced in the defendants' process necessarily performs any other function than permanency in the froth and extremely minute emulsion. He allows that there may be oil in excess, and that some of the particles may get oiled, but states that this is entirely and absolutely unessential. He does not, however, think that more than the necessary quantity of oil is introduced to effect concentration, but that, having regard to the nature of the problem, it is a matter of conjecture, and exact calculation is not possible. Finally, he reiterates his opinion that the defendants' process can be accounted for without assuming selection of the metallic particles by oil. Applying this evidence, their Lordships find that the respondents do not, either directly or indirectly, use the invention claimed by the appellants, but a process essentially distinct, and that there is no infringement.

Briefly, therefore, though both processes use oil and acid, the function of the oil in the Ore Concentration Co.'s process is held to be to coat the sulphides, while the function of the oil in the Sulphide Corporation's process is held to be to form permanent froth and an extremely minute emulsion into which the sulphides are carried by adhesion to bubbles formed in warm acidulated water. The processes therefore differ in action and the Minerals Separation wins the case. The zinc industry at Broken Hill now sleeps in peace.

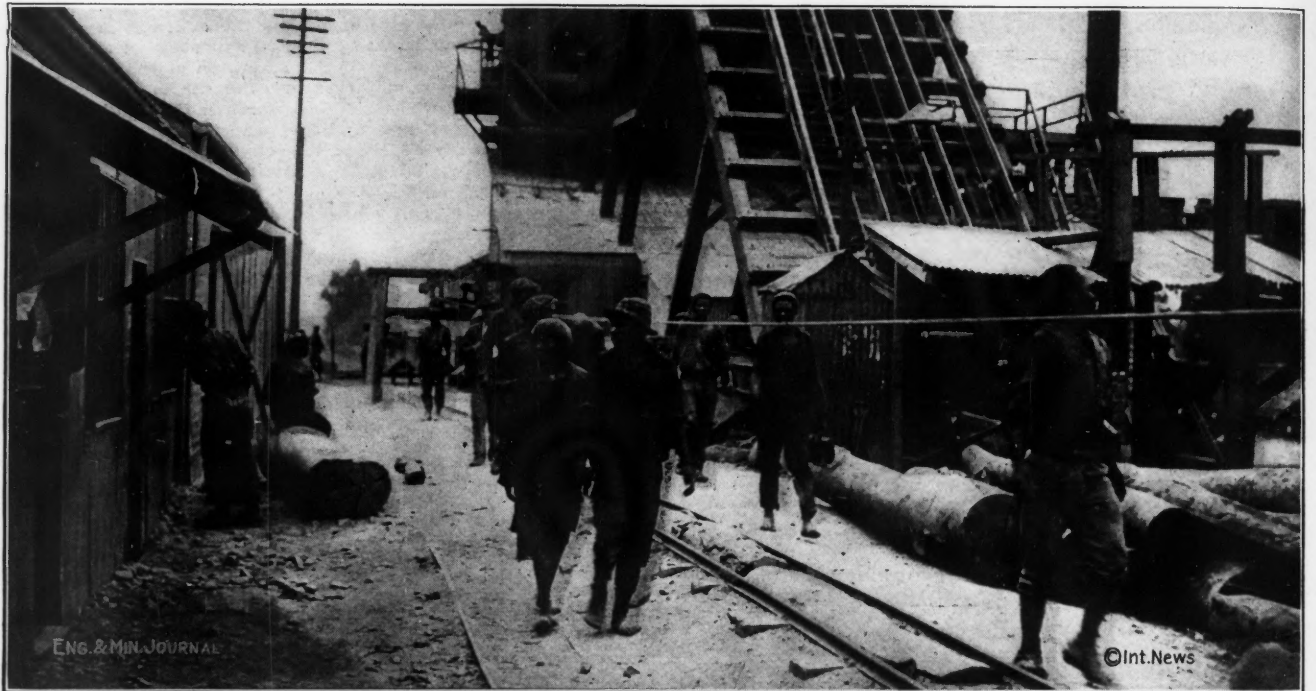
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## Oil Firing on the Austrian Railways

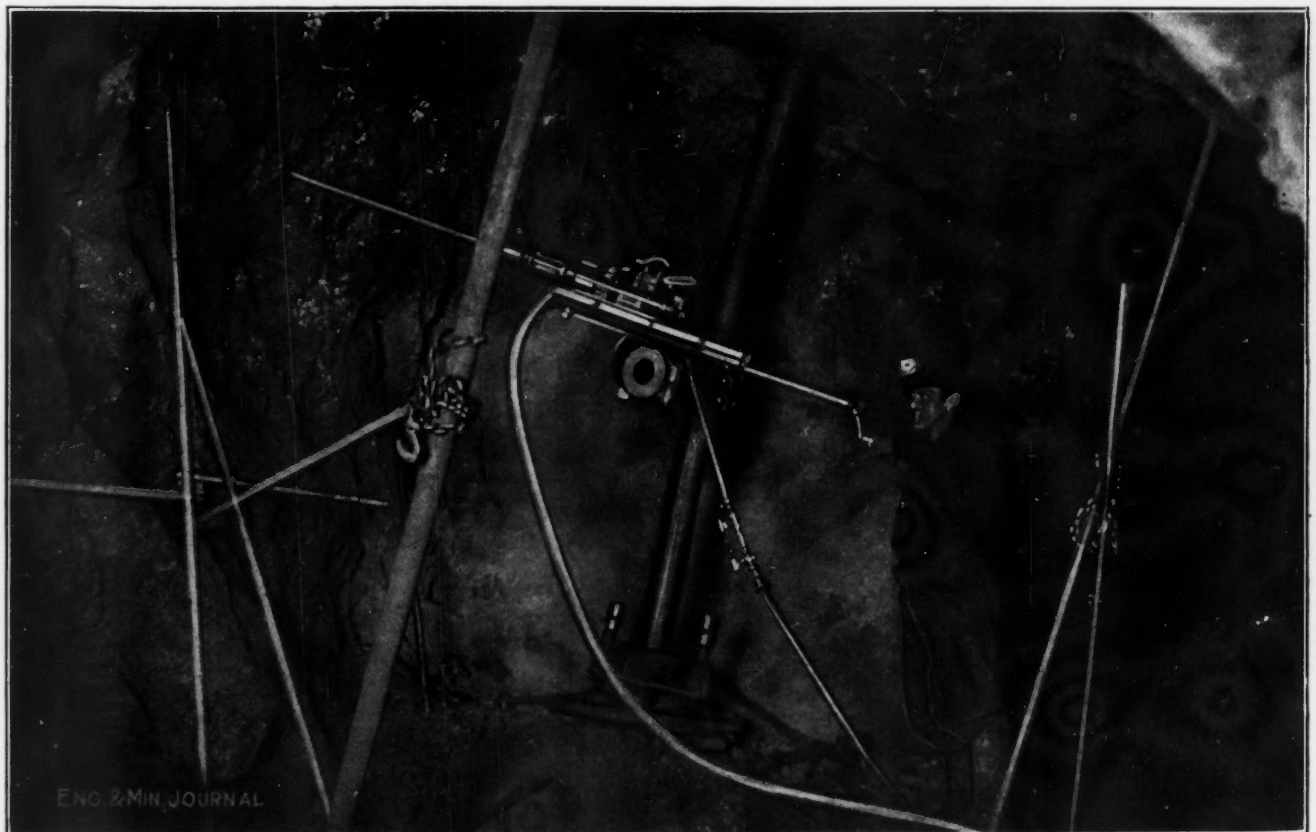
SPECIAL CORRESPONDENCE

Owing to the steady rise of petroleum in price the management of the Austrian government railways has decided to abolish the firing of locomotives on its lines with this kind of fuel and return coal; 300 locomotives have already been changed over to coal firing and the balance—800 in all—will be so changed as rapidly as possible. This arrangement also involves the stoppage of the government oil refinery at Drohobycz, Galicia, which has cost millions of crowns. The object of the latter was to deprive the petroleum of its benzine previous to using it as fuel oil. The engineers and firemen are said to be glad of the abolishment of oil firing on account of the labor in keeping the burners from clogging and of other detriments.

## Photographs from the Field

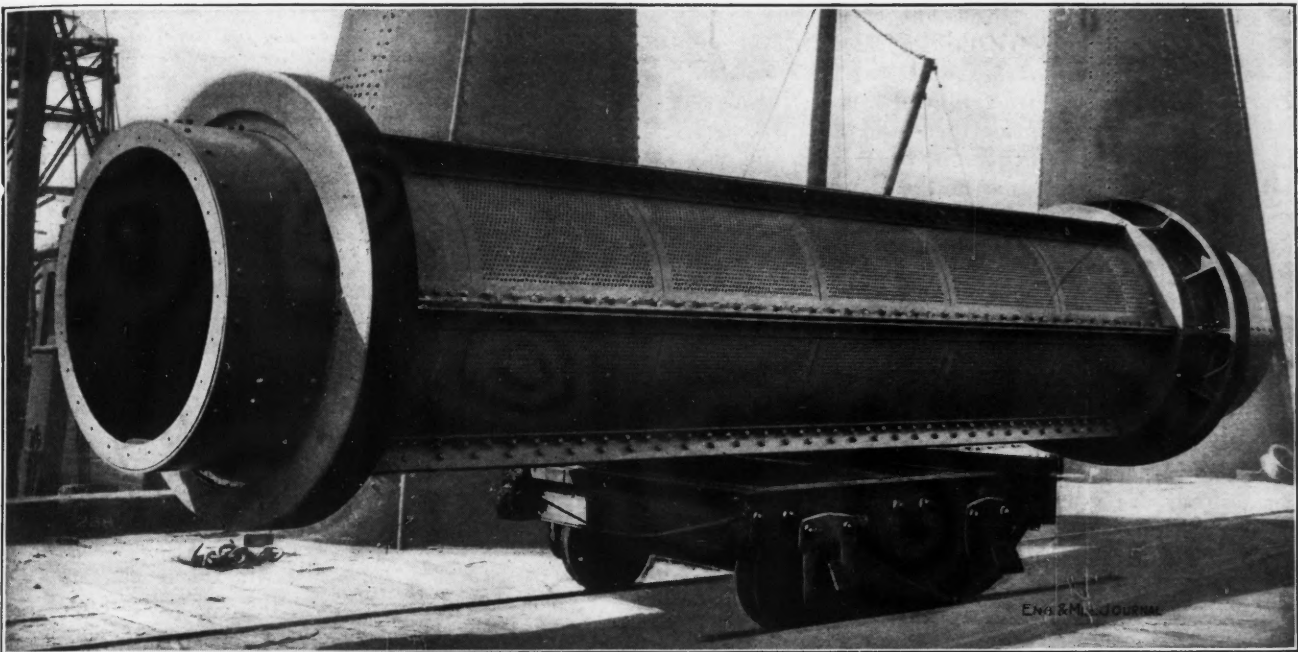


KAFIR MINERS AT THE ROBINSON GOLD MINE, JOHANNESBURG, TRANSVAAL  
The Crown Mines, Ltd., is soon to absorb the Robinson.

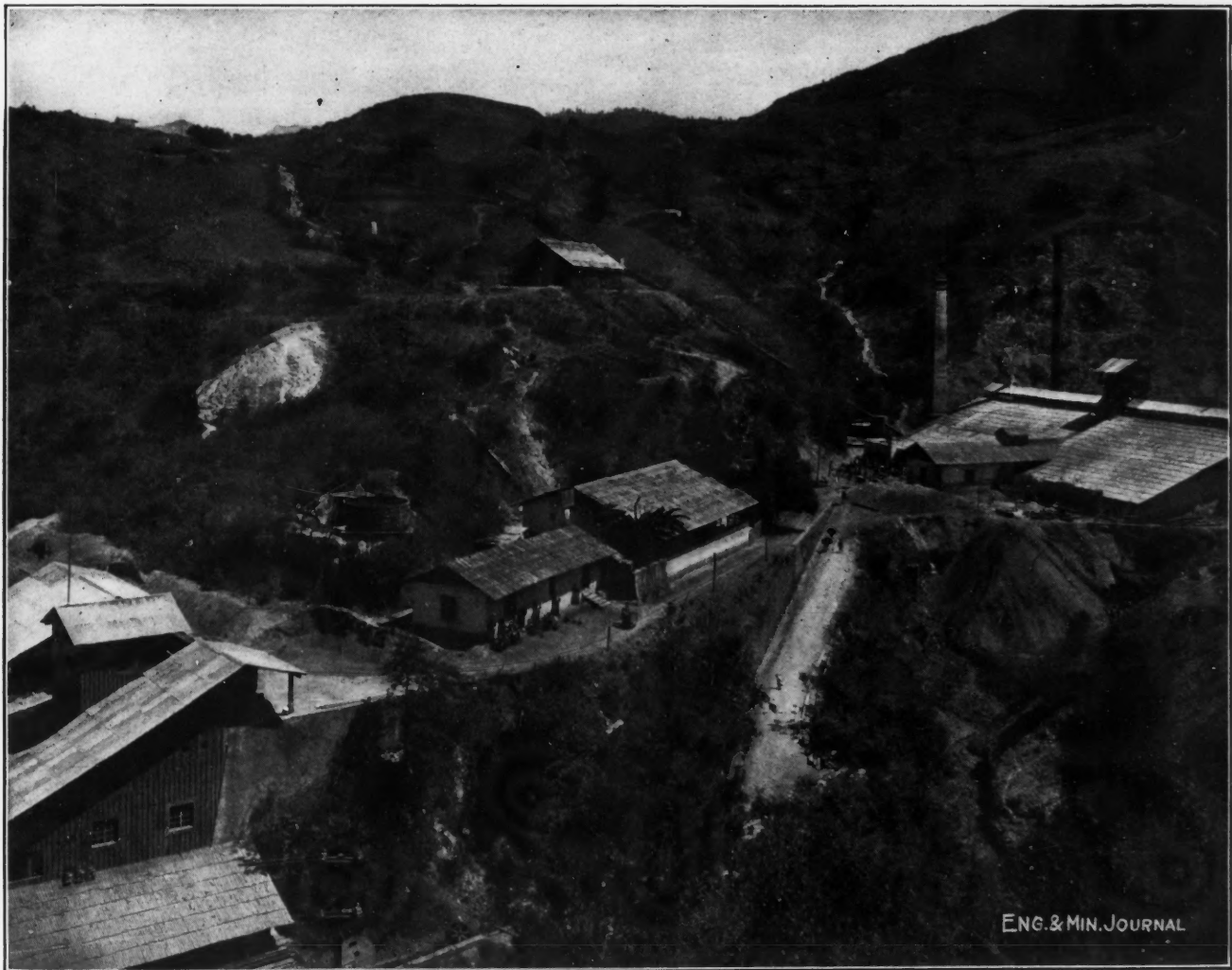


A WATER LEYNER DRILL IN OSCEOLA AMYGDALOID IN THE CALUMET & HECLA MINE  
In the deep workings in the Lake Superior copper mines, especially in raising, the dust-allaying features of this drill are among its most desirable attributes.





REVOLVING SCREEN FOR THE MAGPIE DREDGE, AT CAÑON FERRY, MONTANA  
The Magpie Development Co. operates a 5-cu.ft. electric driven, bucket-ladder dredge.



RINCON SILVER MINE NEAR TEMASCALTEPEC, STATE OF MEXICO  
Roofed headframe and inclosed patio at right, old mill at left, pipe line under 300-ft. head in background. Daily production 100 to 200 tons of ore.

## Great Falls Reconstruction

In an informal talk at the meeting of the New York Section of the Mining & Metallurgical Society, Mar. 19, Charles W. Goodale gave some interesting facts concerning the Great Falls reconstruction, which is costing about \$2,000,000. The concentrator there will be abandoned, as the freight rate on ore is 75c. to Great Falls, and only 14c. to Anaconda. A portion of the concentrates (3:1 concentration) and some of the high-grade ore will be henceforth shipped to Great Falls for smelting.

Some long blast furnaces of the Anaconda type will probably be built at Great Falls. The new buttressed reverberatories, popularly known as "battleships," are doing well, smelting about 200 tons of calcines per day with about 100 tons of coal carrying 20 to 25% of ash. Gas firing from a separate central producer plant has been abandoned, but for all practical purposes the fireboxes on the big furnaces may be regarded as 100-ton producers. They are grated by means of rotating water-cooled grate bars, fitted with spikes, which are rotated and break up the clinker.

Trouble was formerly experienced in the checker work of the old regenerative gas-fired furnace from ash and flue dust. Stoves are not yet in use on the new furnaces but will be tried. Some of the Anaconda metallurgists are now turning their thoughts toward coal-dust firing.

In one of the new basic-lined converters 20,000 tons of bullion has been produced, and the end is not yet in sight. This is in great contrast to the old acid linings, where 14.8 tons of bullion was insisted upon as the proper duty.

Mr. Goodale also spoke of some remarkable minerals found in Butte, containing tin, vanadium, tungsten, etc. Mr. Catlin said that Franklin Furnace was the place for peculiar minerals. Geologists from all over the world came there and immediately began picking up specimens, remarking:

"This is the one I long have sought  
And wept because I found it not."

Recently one of his assistants has told him there were 125 zinc minerals known there. However, there had been one or two more discovered since then.

## New Mine and Mill Construction

*Copper Queen Consolidated Mining Co.*, Bisbee, Ariz., broke ground Feb. 4 for a test concentrating mill, of 50 tons daily capacity, which will cost \$40,000, and is scheduled for completion June 1, 1914.

*St. Francis Gold Mining Co.*, Moretown, Calif., broke ground Mar. 1, for a 5-stamp mill of 16 to 20 tons daily capacity, which will cost \$3000, and be completed Apr. 10.

*Dorit Mining, Milling, Tunnel & Transportation Co.*, Idaho Springs, Colo., will break ground Apr. 15 for an amalgamation and concentration works of 50 tons daily capacity, which will cost \$25,000, and be completed Aug. 1; a cyanide plant is to be built later.

*United Zinc & Lead Co.*, Leadville, Colo., will break ground May 15, for a zinc oxide plant of 50 tons daily capacity at the start and which will be completed in August.

*Anaconda Copper Mining Co.*, Butte, Mont., has completed plans and estimates for a 2000-ton leaching plant to cost \$1,125,000, and to be ultimately enlarged to

treat 10,000 tons per day; work to commence May 1.

*George Threlfall*, Candelaria, via Mina, Nev., is planning to build a mill of 25 tons daily capacity.

*Legitimate Mines Co.*, Jarbidge, Nev., is making plans for a small mill for treating gold ore.

*Sunset Mining & Development Co.*, Rhyolite, Nev., will break ground Apr. 1 for a cyanide plant for treating 2000 tons of gold ore per month, which is to cost \$30,000, and, it is expected, will be in operation in July.

*West End Consolidated Mining Co.*, Tonopah, Nev., broke ground Nov. 15, 1913, for a 10-stamp addition to its 20-stamp mill, increasing the capacity by 50 tons daily and which cost \$30,000. The installation was completed Mar. 10, 1914, bringing the total capacity of the mill to 220 tons per day.

*Lennan Zinc & Lead Co.*, Miami, Okla., will begin the erection of a new concentrator in April.

*Cossak Mining Co.*, Bland, N. M., broke ground Jan. 1 for an all-sliming cyanide plant of 100 tons daily capacity, to cost \$75,000, and which is scheduled for completion June 1.

*Northern Ore Co.*, Edwards, St. Lawrence County, N. Y., has altered its mill for the concentration and separation of blende from pyrite, and when changes have been completed, it will have capacity for treating 60 tons per day, and the changes will have cost \$15,000; work will be completed Apr. 1, 1914.

*Chontalpan y Anexas, Tetepac*, Guerrero, Mexico, is reported to have ordered five additional stamps for the mill.

*Escorpion Mine*, Hostotipaquillo, Jalisco, Mexico, is reported to be planning a 10-stamp mill and cyanide plant.

*Mutual Mining & Milling Co.*, Mexico City, is reported to be building a concentrator.

## Zinc Smelting in Blast Furnace

Thomas Huntington and Ferdinand Heberlein, in U. S. Patent No. 1,069,085 (July 29, 1913) refer to past failures in carrying out zinc distillation in blast furnaces, owing to the oxidation which the zinc vapor experiences. They say that in blowing a charge in a Huntington-Heberlein pot in direction opposite to the normal, i.e., from top downward, they have observed that oxidation of the zinc vapor can be avoided, so that the vapor on leaving the charge may be almost completely condensed in a compact metallic state. They attribute this to the maintenance of conditions preventing the existence of any oxidizing gas in company with the escaping vapor, their ability to accomplish which is ascribed to the prevention of blow-holes when the charge is worked by down-draft. The tapering form of the charge in the ordinary conical pot is considered to be of a certain importance.

Huntington and Heberlein, in their patent specification, speak several times of "the startling results" obtained by their discovery, and mention trials on which their invention is based as being carried out in a converter furnace, such as is used in the H.-H. process for roasting lead ore. Apparently, therefore, the obtaining of spelter in this way has been a fact accomplished in experimentation. Inasmuch, however, as the date of the application of this patent is Oct. 25, 1910, and nothing has been heard of the development of the process, it may be surmised that some difficulties in application were experienced.



# Correspondence and Discussion

## Cuban Iron Ore

A statement is made on p. 142 of the JOURNAL of Jan. 10, 1914, that "In the West Indies, Cuba was the most important mining state, although its iron mines were not so active as in previous years." This seems to me somewhat misleading, and suggests that the following tabulation of the output of the iron mines now operating in Cuba, since the opening of the first mine in 1884, might be of interest:

Year	CUBAN IRON-ORE PRODUCTION				
	Spanish American Iron Co.		Juragua Iron Co.	Ponupo Manganese Co.	Total
	Daiquiri	Mayari	Total		
1884 to 1894 incl.				2,237,041	2,237,041
1895 to 1908 incl.	4,489,305		4,489,305	2,701,023	7,190,328
1909	514,066	7,875	521,941	353,485	935,054
1910	523,132	167,179	690,311	318,814	1,171,673
1911	513,730	365,860	879,590	355,132	1,402,795
1912	537,224	503,333	1,040,557	402,560	1,570,444
1913	489,691	442,119	931,810	408,116	1,465,296
<b>Total</b>	<b>7,067,148</b>	<b>1,486,366</b>	<b>8,553,514</b>	<b>6,776,171</b>	<b>15,972,631</b>

1911, record year for El Cuero Mines.  
 1912, record year for Daiquiri and Mayari Mines and for Cuba.  
 1913, record year for Juragua Mines.

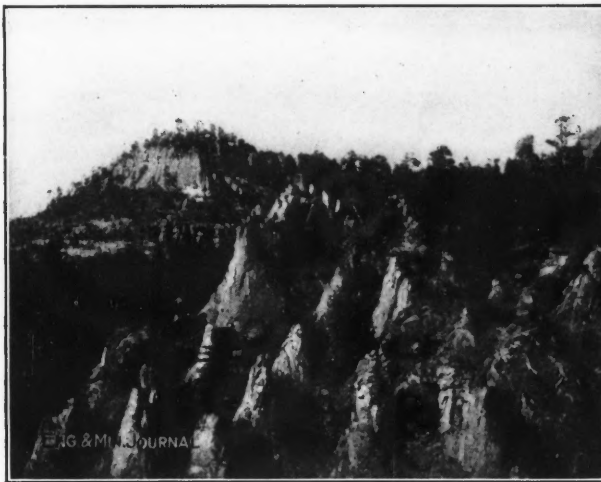
It is evident from the above figures that Cuban iron mining was not only in a healthy condition during 1913,

fuse cut in this manner into a blasting cap than when it is cut straight across, we do not consider it good practice for two reasons: It makes a pointed end on the fuse which is liable to be bent over the powder core and cause an occasional misfire. With tape fuse especially, and with almost any fuse to a certain extent, the insertion of this sharpened point, especially when the fuse is cold and hard, is not without danger. The composition of the filling of blasting caps is exceedingly sensitive. One of our cautions is: "Don't attempt to take blasting caps from the box by inserting a wire, nail or other sharp instrument." To make sure the blasting cap will fire, and for safety also, it is better to cut the fuse straight across rather than slanting.

F. H. GUNSOLUS.  
 E. I. du Pont de Nemours Powder Co., Wilmington, Del., Mar. 23, 1914.

## The Basaseachic Fall

Mr. Linton's article in the JOURNAL of Feb. 21, describing the generation of power at Ocampo and the pos-



CURIOUS EROSION RESULTS IN THE TUFF



NATURAL BRIDGE AT THE BRINK OF THE FALL

but that it was the best year in its history with the one exception of 1912, which is likely to hold the record for some time to come.

D. B. WHITAKER.

Santiago de Cuba, Jan. 31, 1914.

## Method of Cutting Fuse

We notice in the JOURNAL of Mar. 21, 1914, a description, by S. R. Moore, of a fuse-cutting bench. Mr. Moore states that: "If a glancing blow be given on a good chopping block with a sharp ax, the end of the cut fuse will cap better than when cut with a knife and equally as well as when cut with a crimper."

While it is perfectly true that it is easier to insert a

sibilities of Basaseachic Fall, I found of unusual interest, as having visited the Fall myself a few years ago.

The scenery there is so unusual as to make it the equal so beautiful and unusual as to make it quite the equal of many of our national parks. Aside from the Fall itself, the deep, narrow gorge below, with its columned walls almost vertical, but showing a good deal of vegetation and colored dark red and green, is probably almost unique. Above the Fall, the stream has carved a curiously tortuous bed in the tuffs which make up the country, and the sides of the valley show erosion remains of striking configuration. The chimney rock shown in one of the photographs is one of several similar. It is perhaps 50 ft. high and roughly cylindrical. The group of curious cones of almost identical shapes and sizes

would in this country be named probably the "So-many Something Sisters." The most interesting erosion feature is the natural bridge which spans the stream only a few feet from the brink of the Fall. Its length shown in the picture is perhaps 15 ft. The very edge of the Fall is accessible to the visitor, there being a natural stone bench behind which he may sit or kneel and look straight down to the bottom of the gorge. It is unfortunate that the inaccessibility of this spot, three or four



PINNACLE ROCK ON THE SIDE OF THE BARRANCA

days from the railroad even when the country is at peace, has made is known to relatively few people.

ROBERT OLDS.

New York, Feb. 23, 1914.

### Precious-Metal Values, Past and Present

Three mining engineers were gathered together the other day, I being one of them, and the question as to the value of an old trade dollar came up. Strange as it may seem, no one knew its value and there was considerable haziness as to the exact value of an ounce of pure gold, or of the old-fashioned value of an ounce of silver, previous to the "crime of '73," and calculations which I made, seemed to indicate that the ratio of gold to silver in 1870, was not exactly 16 to 1. Possibly, it may be of interest to the profession to know the exact figures which I have received from Mr. Frederic P. Dewey, Assayer of the Mint Bureau, United States Treasury.

Coinage value of one ounce pure gold is \$20.-671834625. A convenient fact, easy to remember, regarding this figure is that 43 oz. of coin gold, 900 fine, are worth \$800.

Coin value of an ounce of silver in 1870.....	\$1.2929
Coinage value of a trade dollar in 1870.....	1.01818
The coinage value of a Mexican dollar in 1870.....	1.0159-

The trade dollar was coined so that it might be used in the Orient on a parity with the Mexican dollar, which it slightly exceeded in value. The Mexican dollar, no

longer coined, weighed 417.74 grains and was 902.7 fine, slightly in excess of the United States fineness of 900.

In 1870 the ratio of gold to silver was not 16 to 1, but 15.9884— to 1. This silver ratio has been discontinued, and the ratio for the present subsidiary coinage is 14.-95349 to one.

J. PARKE CHANNING.

New York, Feb. 19, 1914.

### Placer Recovery of Platinum

I note in two recent numbers of the JOURNAL considerable discussion in regard to the analysis and assays of sands containing platinum-iridium, etc. I had a little experience with these metals when working on the U. S. Geological Survey, at Portland, Oregon, in 1905. We there found that if one make a solid amalgam of mercury and sodium by simply putting small fragments of sodium in contact with mercury until the mercury has become solidified, and use this amalgam for picking up gold in black sand, it is remarkably quick to pick up the gold. It is also quite as quick to pick up the platinum, and I believe, the platinum-iridium. But this curious thing happens, that as soon as the sodium has become completely oxidized from contact with water, the platinum, and, I believe, also the platinum-iridium, are no longer retained in the amalgam, but come out from it and have no more affinity for the quicksilver than does quartz.

On account of the rush of work which I had on hand, I was unable to prove whether this is universally the case so that it could be used as a means of separation of the two metals, or not, but as far as I went, it seemed that it probably was so. The only portion of the gold which might be left with the platinum, if this was used as a method of separation, would be the gold contained in included grains of other minerals. I am inclined to think, therefore, that these could be separated completely on the pan, so that the pan and the sodium amalgam may make a complete means of rapid separation between gold and the platinum metals.

My reason for suggesting that this note be put in the JOURNAL is that some of your correspondents who are working on this subject might be inclined to try it and prove whether it is as efficacious as it seems to me to be.

ROBERT H. RICHARDS.

Boston, Mass., Mar. 2, 1914.

### Otto von Graeve

I am sorry that you did not publish some comments on the article appearing in the JOURNAL of Feb. 7, p. 312, "Otto von Graeve, a Modern Dowser." A great many people are already easily fooled by the "mineral rod" man, and unless something more is said about this article, it will go a long way in confirming them in their belief, and result in them being imposed upon by such men as this "modern dowser."

A. H. PURDUE.

Nashville, Tenn.

[After all of the irony, jesting and sarcasm that we have let loose upon the dowser, the mineral-rod man, the exponents of goldometers, Spanish needles, etc., we did not think that the last article required any special comment.—EDITOR.]



# Editorials

## The Flotation Patent Litigation

An important decision was rendered by the Privy Council of England, on Mar. 6, which finally determined the long litigation between the owners of the Elmore oil concentration patent and the Minerals Separation, Ltd., and its licensees, operating the Sulman, Pickard & Ballot process. The history of this prolonged litigation was reviewed in the JOURNAL of Mar. 14 last. A decision was rendered by the House of Lords in 1909 in favor of Minerals Separation, which finished the case so far as the British patents were concerned. There being some difference in the Australian patents, however, the Elmore people were able to carry on the fight in Australia, and being defeated there, were able to bring the case on appeal once more before the highest court of the Empire.

The Privy Council, insofar as it acts upon appeals from judgment in the colonies, is made up of the law lords, who also act upon all appeals from judgment of the English courts to the House of Lords. Technically, the Privy Council and the House of Lords are courts of coordinate jurisdiction, and in fact they are composed of the same judges, the one deciding appeals from the colonies, and the other deciding English appeals. Since 1909 the composition of these courts has so changed that not one of the five law lords, who decided the House of Lords case in that year, participated in the present judgment. The matter between Elmore and Minerals Separation, has, therefore, been decided by 10 law lords, five in each case.

The gist of their decisions is that the Sulman, Pickard & Ballot process of agitation-froth flotation and the Elmore process of bulk-oil flotation, in which the mineral particles are entrapped in oil and thereby floated to the surface, are two different processes, and consequently that the former is not an infringement of the latter. This sets Minerals Separation free from claims that itself is an infringer. Incidentally, the validity of the Elmore patent itself was certified by the Privy Council.

The litigation, now pending in the American courts, is of wholly different character. In this case Minerals Separation and its American subsidiary are suing James M. Hyde and the Butte & Superior Copper Co., whom it alleges to be infringers. The defense is that the Sulman, Pickard & Ballot patent is invalid for the reason of prior disclosures in the art. Thus, in this case the validity of the Minerals Separation process is challenged for the first time in the country where the Everson patents originated and where there was the fullest publication respecting them and the experimental work done under them.

In the first trial of this case, viz., the action against James M. Hyde, at Butte, Mont., Judge Bourquin rendered a decision in favor of Minerals Separation. In the second trial, viz., the action against the Butte & Superior Copper Co., the same judge rendered a similar decision. The case was recently argued before the Circuit Court of Appeals in San Francisco and a decision by that court is expected before many months.

At the present time, we have therefore at least three

different types of flotation processes in practical use, viz., the bulk-oil process, exemplified by the Elmore, in which minerals are enveloped, more or less, by oil and thus floated; the froth-agitation process, in which the ore pulp mixed with a little oil and sulphuric acid is stirred violently, causing certain minerals to rise as a voluminous, persistent froth; and the surface-tension process, exemplified by the Macquisten, in which the ore is slid upon a surface of water in such a way that certain minerals may be buoyed up, just as the greased needle is made to float in the classic experiment of the classroom in physics. With regard to the last process there has been no litigation that we recollect, at least none of far-reaching scope. The process itself has been so far of but limited application and probably none of the patents pertaining to it are of generic character. The froth-agitation process is commercially the most valuable of all the flotation processes and naturally the contest centering upon it has been the hardest fought.

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## Will Copper History Repeat?

A subscriber to the JOURNAL has called our attention to a recent editorial in the *Boston News Bureau* on the waves in the copper industry when supplies of copper have run short, with the result of a high range of price for the metal, giving a statistical presentation in support of the view that conditions are shaping themselves to produce such a wave of high price once more. Our correspondent inquires moreover respecting the accuracy of the statistics. Our reply will perhaps be of interest to many readers.

We think that the main point in the editorial of the *Boston News Bureau* is well taken. We have previously expressed ourselves in the JOURNAL in about the same way, although more conservatively. Mr. Bayliss, of the Exploration Company, whom we quoted not long ago, apparently holds similar views and has been making copper-mining investments in behalf of his company. And moreover, we know that important commercial interests in copper production entertain the same ideas.

As to the statistics cited by the *Boston News Bureau*, they do not look just right. Respecting the world's production of copper, there are three original authorities, viz., Henry R. Merton & Co., Aron Hirsch & Co., and ourselves. These are not wholly independent, inasmuch as Merton & Co. use our figures for the United States and some other countries and we use their figures for Spain and certain other countries. Similarly there is an exchange of figures between Aron Hirsch & Co. and ourselves. The respective totals differ somewhat, but to no such extent as to vitiate results, considering the magnitude of the totals. Our own figures for the last four years are as follows, in metric tons:

1910	.....	882,351	
1911	.....	886,855	
1912	.....	1,020,022	
1913	.....	1,000,716	(preliminary estimate)

The statistics of consumption are far less accurate than statistics of production. The figures of the world's consumption of copper, in metric tons, during the last four years, as computed by the Metallgesellschaft, Frankfurt-am-Main, Germany, are as follows:

1910 .....	912,100
1911 .....	939,800
1912 .....	1,038,600
1913 .....	Not yet reported

Without attempting to draw deductions too finely, there is no question about consumption having exceeded production during the last four years, for the reason that while production has increased, stocks have decreased. On Jan. 1, 1910, the visible supply in Europe and America was 175,075 metric tons; on Jan. 1, 1914, the reported stock was 57,039 metric tons. These figures are not precisely comparable, inasmuch as the former includes copper afloat from Chile and Australia, while the latter excludes the copper afloat from these countries, but includes the stocks at Rotterdam and Hamburg, which were not reported at the earlier date. However, these discrepancies do not materially alter the showing that the world's stock of copper decreased about 118,000 metric tons from Jan. 1, 1910, to Jan. 1, 1914.

There is no doubt, therefore, that during the last four years the consumption of copper has been increasing more rapidly than the production and that the present statistical position of the industry is very strong. Without having reference to immediate market movements, up or down, it looks as if copper will probably become a dearer commodity in one, two or three years.

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### Hydrometallurgical Apparatus

The advances in an art may often be foreseen long before their arrival. Processes may be worked out in the laboratory, and may be perfect in theory, but prove incapable of practical application because of the lack of proper materials for the apparatus. To some extent the hydrometallurgy of copper has been in this plight.

The fused magnetite anode, to which we have several times referred, and of which it is our hope to print a good description shortly, seems to have solved one difficulty. Unaffected by oxygen, sulphate ions, or nascent chlorine, its sole drawback seems to be its brittleness. The tank question now also seems to be solved by the asphalt-lined concrete tank, concerning which we publish an article this week.

It was only a few days ago that we heard one of America's leading metallurgists express the opinion, that in the asphalt-lined tank and the fused-magnetite anode he could see the conquerors of the smelting furnace.

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### The Spirit of Fair Competition

The National Lead Co., which is a large manufacturer of white lead and other lead products, is often referred to as the "trust" in its particular line of business. There was a time, about 25 years ago, when it was a trust in recognized name. This was back in the days when the term obtained its significance. Since then the National Lead Co. has been simply a big corporation, but although the biggest in its field, it has had a lot of competition. A few weeks ago an incident occurred which is mentioned in the last annual report of the company as follows:

On Feb. 11, 1914, the plant of one of our most important

competitors in the white-lead business was completely destroyed by fire. Coming as it did at the opening of the spring trade, it meant for this competitor loss of its entire business, as it would require fully a year's time to replace its plant and bring it to a point of actual production. We did not rejoice in this misfortune, but on the contrary, placed in our competitor's possession one of our surplus plants, so that it could at once continue in business and supply its trade.

This is not at all in accord with the conventional idea that the managers of big corporations lie awake of nights trying to think how to stifle competition. On this occasion, the big company says that it welcomes intelligent competition, believing it to be a healthy condition, which it would not have otherwise. The absence of competition leads to stagnation and dry-rot. The National Lead Co. would not have gained anything in the long run by trying to seize the customers of its unfortunate competitor. On the contrary, it takes the opportunity to realize some use of one of its idle plants and at the same time makes a friend of its competitor.

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### Colonel Gorgas on the Rand

Liberal quarters and abolition of the compounds for the Kafir miners were among the most important recommendations made by Colonel Gorgas after his recently completed investigation of the industrial diseases to which the native workers in the mines at and around Johannesburg, in the Transvaal, were subject. The investigation was invited by the Rand Chamber of Mines. Pneumonia and other pulmonary diseases have long worked disastrously among the miners, and have come to be the subject of great consideration on the part of mine operators and the authorities having control of mining conditions.

Segregation is recommended not as a cure, but as a means of lessening the dissemination of pneumonia. Colonel Gorgas evidently made further recommendations which will doubtless soon be reported by the Chamber of Mines and it is expected that from them much can be learned that will benefit the underground workers in other parts of the world if the operators are keen to appreciate the value of the Colonel's suggestions.

The investigation was extended to Rhodesia where malaria is endemic in several places. Colonel Gorgas conceded the task of elimination of malaria in Rhodesia a far easier task than it proved to be in Panama. The country is salubrious and well drained, an educational campaign and other sanitary measures carried out as at Panama should easily drive malaria from the country.

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The Colorado courts have been wrestling with the problem of what constitutes the gross proceeds of ore, which is one of the elements entering into the valuation of mines for the purposes of taxation under the law of that state. The question resolved itself into this: (1) Are the gross proceeds of an ore what the miner realizes at his place of production; (2) or what he realizes after he has delivered it to the smelter's works. The Supreme Court of Colorado, after pronouncing in favor of the latter construction, has reversed itself and adopted the former, which looks to us like common sense.

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The report of the American Smelting & Refining Co. for 1913, showing a decrease of \$3,500,000 in gross earnings, reflects the disastrous effect of the Mexican troubles upon the mining and metallurgical industries.



## BY THE WAY

"Alaska cost the United States \$7,300,000 in 1867 and produces three times that amount in minerals annually," says a contemporary. Well, what of it?

Recent climatic hardships in New York remind us of the pronouncement made by Sammy Trebilcox, one-time foreman of the North Star mine, when a particularly snowy winter made the tramp out from Grass Valley somewhat arduous: "Damme, boys, Hi doan' mind the rain, but when she snaws, theer she be."

When it was necessary to shut down some of the Gary blast furnaces at one time, it was found that there would not be enough gas from the other furnaces for use around the plant. According to E. G. Spilsbury, this was avoided by running one furnace as a gas producer, and putting in just enough iron ore to flux the silica of the fuel, making ferrosilicon as a byproduct. J. E. Johnson, Jr., said they had also added openhearth slag to flux the silica, thus making ferromanganese as a byproduct.

In a recent informal discussion of smelting and its troubles, Charles W. Goodale spoke of the "sulphur bugs," an insect which, according to his statements, thrives only in super-tropical temperatures with plenty of sulphur smoke, and has a remarkable knack of getting on the back of the smelter's neck when both his hands are occupied. Another smelter said he had noted them in California, where they had annoyed the Shasta County operators, but had not been known elsewhere in the state until Shasta County ores were shipped to San Francisco Bay points, when they had appeared there. Apparently, no entomologist has yet passed on the genus and species of this animal.

We have always felt that the tales of lone prospectors unexpectedly confronted in the Arizona desert by real live camels, were for the most part fiction, whether admittedly so or not. It is a fact, however, that camels were once introduced into the Territory of Arizona by the Government in the effort to solve the problem of desert transportation. It is not so well known that nine Bactrian camels were also brought to Nevada in 1861 by private parties for use in transporting salt from Sand Springs to Virginia. George J. Young calls attention to this fact in a history of mining in Nevada, and states that their use proved impracticable. The camels must have thrived for a while at least in Nevada, since Professor Young states that the Nevada legislature in 1875 passed an act to prohibit camels running at large upon public highways.

The *Iron Trade Review* says: The Kokomo Steel & Wire Co., which has been operating a rod and wire mill for thirteen years, has recently added a blooming mill and two large open-hearth furnaces to its equipment, in order to provide its own supply of billets, and thus avoid dependence on the open market for semi-finished steel. This company, therefore, ceases to be a purchaser of billets. Two hundred miles away, the Wisconsin Steel Co., a sub-

siidiary of the International Harvester Co., has added to its plant a merchant-bar mill with a capacity of 3000 tons per month on single turn, in order to bring the finishing capacity of the works to a parity with the steel-making and blooming-mill capacity. This company will, therefore, have no more billets to sell. One manufacturer builds a blooming mill because the purchase of billets in the open market is unprofitable; and another builds a finishing mill because the sale of the same product is equally unsatisfactory. Thus the floating supply of semi-finished steel is becoming more and more curtailed, and the tendency toward concentration in the steel business grows apace. The net result is to reduce the amount of competition in the trade, regardless of the theory of legislators.

An appreciative, but unfortunate, subscriber in Mexico writes us a letter, which throws some interesting sidelights upon what miners there have suffered and what they think. He said: Yours of the 4th inst. just been received. I appreciate the fact that you want me to renew my subscription to the *JOURNAL*. Your paper, which I always read from head to tail (ads included, for they communicate some of their optimism in our depressed minds), is O.K. in every respect, and I hate the worst way in the world to discontinue. But I am broke. I went to see a miner friend of mine to whom I usually pass the *JOURNAL* after my reading of it, and asked him to go halves in the subscription. He refused because he also is broke. Now, if you have the patience to read my prose, I'll tell you we are busted on account of a series of mishaps brought about by the continuous revolutions. When a year ago Huerta took the reins of the government, we began to breath more freely. The well intentioned government of Madero had been pretty bad, and lawlessness had dealt us some hard blows in our neck of the woods, so when Huerta came in, we said: "Fine, here is an old, well tanned soldier, who doesn't believe that democracy and liberty are synonyms of rapine and brigandage; he promises nothing except peace, and that's all we want." And sure enough, the bandits who formerly infested our vicinity unmolested by the Federal troops that sometimes supplied them with ammunitions (yes, Sir!) were given a merry chase, and for some months the dove of peace was our guest. But lo! the President of the U. S. A. and his secretary of state could not forget that Madero and some of his gang had not died like most other people, and would not forgive Huerta for sitting in the presidential chair without having made a single election speech or other lecture. So these gentlemen would not recognize him, thus giving moral support to the rebels and making the task of pacification more and more difficult. To them it is indifferent that the whole country go to ruin, that business be annihilated, that 14 million people be driven slowly (sometimes damn fast) to misery, so long as the presidential succession be not brought about according to the Constitution. And thus the hordes with the standard of "Constitutionalism" burn, destroy, pillage, steal, rape and murder under the benevolent eye of Mr. W. W. I could go on writing for the rest of the night, but it is too sad and it makes me mad, so I jump at the conclusion: I am ruined, my neighbor is ruined, my friends are ruined, and Mr. Bryan would better not come around here when we feel gloomy. In the meanwhile I need my money to buy beans."

## The Proposed Mining Laws

Horace V. Winchell, as chairman of the committee on mining law of the American Institute of Mining Engineers, has issued a circular letter, dated Mar. 1, 1914, which deserves the careful attention of all the readers of the JOURNAL. The letter is as follows:

Mining men have for years demanded revision of the mining laws. There are indications that their demand will soon be gratified. In fact, revision is coming at a rapid pace and will be an accomplished fact before we realize it. There are now pending in Congress bills for mining legislation as follows:

S. 4373. A bill to provide for the appointment of a commission to codify the mining laws and suggest amendments thereto.

S. 4405. A bill to provide for and encourage the prospecting mining and treatment of radium-bearing ores in lands belonging to the United States.

H. R. 13,137. A bill to provide for the leasing of coal lands in the territory of Alaska, and other purposes.

A bill to authorize exploration for and disposition of oil, gas, potassium and phosphates in the public lands.

Other bills for leasing coal lands in the United States and for various other purposes of greater or less importance.

Some of these bills contemplate the introduction of new practices and principles into our mining laws. Thus the leasing idea, to which many of our miners are unalterably opposed, is contained in the radium bill, the Alaskan coal bill, and the oil and phosphate bill, as well as in numerous other coal-land bills. The radium bill goes still further and gives to the Government the right to take possession and operate patented properties, provided the owner does not work them "with reasonable diligence."

The radium bill and the Alaskan coal-leasing bill are thought to be urgent and are likely to be passed soon, in some form or other. The others are receiving the attention of the congressional committees on mines and on public lands, and will be brought up for final passage in due season.

Now, regardless of our views as to the propriety of these various bills, there is one which seems to be generally looked upon as representing the sensible way for Congress to proceed to ascertain the condition of the mining industry and the wishes of mining men as to desired amendments to our laws. That is, the appointment of a commission to study the subject in all its bearings, and to prepare the draft of a revised mining code.

It has been suggested that such a commission should consist of three members, all of them mining lawyers, and that its scope should be limited to metal mines. Our belief is that it should have five members, (1) an experienced mining attorney, (2) a mining geologist, (3) a mining engineer, (4) a representative of the U. S. Geological Survey and Bureau of Mines, and (5) a man who is himself the owner of large mining interests. The commission should also be authorized to cover the entire field of mineral land laws, and all classes of mineral deposits. Piecemeal revision will only lead to still greater confusion, while rational and coordinated laws should be so simple as to make lawsuits less frequent, and mining titles more secure.

Now that there is evident disposition on the part of Congress to grant us some attention, there should be no hesitancy on the part of mining men in making their wants known. If you believe that the proposed commission should be authorized, and that it should have a liberal representation of mining men, and that general mining-law revision can well afford to wait until such a commission has had time to report the draft of a suitable bill, please do not hesitate a moment in saying so to your congressmen. Now is our opportunity. We shall not be heard with patience later. It will be our own fault if the revision now under way does not result in laws best suited to our own industry. The members of the committees who are likely to have the matter in charge are given below. Write today to the chairmen of these committees or to your own senators and representatives.

### COMMITTEES OF THE SENATE

Public Lands—Henry L. Meyers, of Montana; Marcus A. Smith, of Arizona; Charles S. Thomas, of Colorado; Joe T. Robinson, of Arkansas; William H. Thompson, of Kansas; Key Pittman, of Nevada; Joseph E. Ransdell, of Louisiana; William Hughes, of New Jersey; George E. Chamberlain, of Oregon; Reed Smoot, of Utah; Clarence D. Clark, of Wyoming; John D. Works, of California; Albert B. Fall, of New Mexico; George W. Norris, of Nebraska; Thomas Sterling, of South Dakota.

Mines and Mining—Thomas J. Walsh, of Montana; Henry

F. Ashurst, of Arizona; Benjamin R. Tillman, of South Carolina; Key Pittman, of Nevada; John F. Shafroth, of Colorado; Miles Poindexter, of Washington; Albert B. Fall, of New Mexico; Thomas Sterling, of South Dakota.

### COMMITTEES OF THE HOUSE

Public Lands—Scott Ferris, of Oklahoma; James M. Graham, of Illinois; Edward T. Taylor, of Colorado; John E. Raker, of California; Harvey B. Fergusson, of New Mexico; Carl Hayden, of Arizona; Samuel M. Taylor, of Arkansas; Lathrop Brown, of New York; Tom Stout, of Montana; Andrew R. Brodbeck, of Pennsylvania; Denver S. Church, of California; Jacob A. Cantor, of New York; Matthew M. Neely, of West Virginia; Irvine L. Lenroot, of Wisconsin; Burton L. French, of Idaho; William L. La Follette, of Washington; William Kent, of California; Nicholas J. Sinnott, of Oregon; Jacob Johnson, of Utah; Charles M. Thompson, of Illinois; James Wickersham, of Alaska.

Mines and Mining—Martin D. Foster, of Illinois; Edward T. Taylor, of Colorado; Courtney W. Hamlin, of Missouri; James F. Byrnes, of South Carolina; Samuel M. Taylor, of Arkansas; John M. Evans, of Montana; Peter J. Dooling, of New York; John J. Casey, of Pennsylvania; Joseph Howell, of Utah; Robert M. Switzer, of Ohio; Richard W. Austin, of Tennessee; E. E. Roberts, of Nevada; Howard Sutherland, of West Virginia; James Wickersham, of Alaska.

Kindly send me copies of your recommendations and suggestions.



## Lease of Phosphate and Oil Lands

### WASHINGTON CORRESPONDENCE

Senator Walsh has introduced a bill to promote the mining of phosphates, oil and other minerals on the public domain, which has been referred to the committee on mines and mining. The salient features are as follows:

The Secretary of the Interior may lease to any person qualified under this act any lands belonging to the United States containing deposits of phosphates, under specified restrictions and terms. Each such lease shall be for not more than 2560 acres, to be described by the legal subdivisions of the survey, or if unsurveyed, by permanent monuments so placed that the boundaries can be readily traced, the land not exceeding in length more than  $2\frac{1}{2}$  times its width.

For the privilege of mining and disposing of the phosphates, the lessee pays such royalties as shall be specified in the lease, which shall be not less than 2% on the gross value of the output of phosphates at the point of production, and an annual rental at the beginning of each year at the rate of \$1 per acre, the rental paid to be credited against the royalties accruing for the same year. Leases may be for indeterminate periods.

As to oil and gas, the Secretary of the Interior is authorized to grant to any qualified applicant a prospecting permit, which shall give the exclusive right for a period not exceeding two years to prospect for oil or gas upon not over 640 acres, situated within 50 miles of any producing well, or upon not over 2560 situated over 50 miles from any producing well. The permittee must begin operations within four months from the date of the permit, and must within one year drill a well to a depth of 500 ft. Within two years he must drill wells aggregating not less than 2000 ft. If the lands applied for are unsurveyed, the applicant must locate the lands in square or rectangular tracts, the length of which shall in no case exceed  $2\frac{1}{2}$  times the width, and mark each of the corners permanently. Upon the granting of a permit for the exploration of such a tract of unsurveyed land, the permittee shall post a notice that such permit has been granted and a description of the lands covered thereby.



## PERSONALS

John Hays Hammond has returned from Europe.

C. W. Goodale, of Butte and Great Falls, is visiting New York.

S. M. Soupcoff, of Denver, is visiting in New York for a few weeks.

Albert H. Fay, of the U. S. Bureau of Mines, left Seattle, Wash., Mar. 16, on his way to Seward, Alaska.

W. Veath, of Tonopah, Nev., who has interests in Josephine County, is looking over his Oregon property.

J. E. Clennell, cyanide expert, is going to Cobalt, Ont., where his address will be in care of the Nipissing Mining Co. after Apr. 1 next.

Roy Wethered has severed his connection with the Consolidated Mining & Smelting Co., of Canada. J. D. Cram is now in charge of the Highland mine in British Columbia.

Harold Lakes, of Ymlr, acting as consulting engineer for the Silver Hoard mine at Ainsworth, B. C., has been on a visit to that property.

Arthur N. Cantrill, of New York, has been appointed manager of the Coalmont Co., operating in the Similkameen district of British Columbia.

Henry Hart, for many years treasurer of the Empire Steel & Iron Co., Catauqua, Penn., has resigned and will enter the automobile business at Reading.

Franklin W. Smith has finished examining mines in central and western Nevada and in eastern California and has left Bisbee, Ariz., for Sonora.

I. F. Laucks, of the firm of Falkenburg & Laucks, Seattle, Wash., is at Silverton, B. C., on professional business for the Standard Silver & Lead Mining Co. of that place.

John H. Jones, of Spokane, Wash., and J. H. Turner, a mining man, also of Spokane, are at Grants Pass, Ore., and will make an examination of mines in Josephine County.

J. W. Sheperdson, assistant chief engineer of the Cambria Steel Co., has resigned to accept the position of assistant general superintendent of the Central Iron & Steel Co., Harrisburg.

H. J. Meehan, superintendent of the Lackawanna Coal & Coke Co., at Wehrum, Penn., has been appointed general superintendent of mines for the Cambria Steel Co., succeeding James W. Cook, resigned.

Charles F. Brooker, president of the American Brass Co., will celebrate the 50th anniversary of his connection with the copper industry on Apr. 14. The occasion will be commemorated by a dinner in his honor, given by the copper producers of North America.

J. E. Thropp, Jr., has resigned the position of general manager for Joseph E. Thropp, Everett, Penn., operator of blast furnaces at Everett and Saxton, and conducting coal and coke operations in Bedford and Huntington Counties, and iron-ore mines and quarries in Pennsylvania, Maryland and West Virginia.

C. P. Perin, consulting engineer for the Tata steel works project in India from its inception, will arrive in New York late in April after a stay of several weeks at the Tata Iron & Steel Co.'s plant at Sakchi, Bengal. His return is hastened by the death of Mrs. Perin, who accompanied him to India.

Albion P. Aiken, one of the oldest superintendents in point of service at the Edgar Thomson Steel Works of the Carnegie Steel Co., has been retired on a pension, after 39 years of service. Charles E. Dinkey, general superintendent of the plant, presented Mr. Aiken a gold watch, in behalf of departmental heads, and paid a tribute to the veteran's devotion to the company.

## OBITUARY

Louis Elliott, a well known mining man in Grant County, N. M., died in Silver City, Mar. 12, at the age of 68 years. He was interested in the Burro Mountains, where he spent a great deal of time and was well versed in conditions there. He was also one of the earlier developers of the Lone Mountain district and made a fortune in that camp.

## NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

**ALUNITE**—Apparatus for Treating Alunite. Howard F. Chappell, New York, N. Y. (U. S. No. 1,089,110; Mar. 3, 1914.)

**BARYTES**—Method of Separating Barytes from Ores. C. J. Greenstreet, St. Louis, Mo. (Brit. No. 16,273 of 1913.)

**CHANNEL FURNACE** for Burning Ore Bricks. Arthur Ramen, Helsingborg, Sweden. (U. S. No. 1,089,868; Mar. 10, 1914.)

**CONCENTRATION**—Improvements in or Connected with Machines for Concentrating and Separating Ores and Other Substances. G. F. Wynne, Minera, Wales. (Brit. No. 2564 of 1913.)

**CONVEYOR-BELT SUPPORT**. Freeman R. Willson, Jr., Worthington, Ohio, assignor to the Jeffrey Manufacturing Co. (U. S. Nos. 1,088,195 and 1,088,644; Feb. 24, 1914.)

**CRUSHING**—Improvements in Apparatus for Stamping or Pulverizing Minerals and the Like. G. H. Harris, Wade Bridge, Cornwall, Eng. (Brit. No. 29,886 of 1912.)

**CRUSHING**—Improvements in Crushing, Pulverizing and Disintegrating Machines. H. T. Tovey Woking, Surrey, Eng. (Brit. No. 5474 of 1913.)

**CRUSHING**—Ore Pulverizer. Oliver J. Moussette, Brooklyn, N. Y. (U. S. No. 1,087,967; Feb. 24, 1914.)

**CYANIDING**—Centrifugal Filtering or Dewatering Machine for Ore Pulp. Jesse C. King, La Junta, Colo., assignor of one-half to Aaron Wilkins, La Junta, Colo. (U. S. No. 1,088,823; Mar. 3, 1914.)

**DREDGE**—Dipper Dredge. George H. Lutz, Dahlonga, Ga. (U. S. No. 1,088,031; Feb. 24, 1914.)

**DRILL**—Percussive Tool. Lewis C. Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,089,038; Mar. 3, 1914.)

**DRILLING**—Rock-Drilling Machine. Charles C. Hansen, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,088,984; Mar. 3, 1914.)

**ELECTRIC FURNACE**. Claude C. Whitmore, Butte, Mont., assignor of one-half to Walker B. Carroll, Butte, Mont. (U. S. No. 1,089,300; Mar. 3, 1914.)

**GAS-WASHING APPARATUS**. Hans Eduard Thelsen, Munich, Germany. (U. S. Nos. 1,088,186, 1,088,187 and 1,088,188; Feb. 24, 1914.)

**MAGNETIC SEPARATOR**. George Ullrich, Magdeburg, Germany, assignor to Fried. Krupp, Aktiengesellschaft, Grusonwerk, Magdeburg-Buckau, Germany. (U. S. No. 1,089,993; Mar. 10, 1914.)

**METALLURGICAL FURNACE**. Henry D. Hibbard, Plainfield, N. J. (U. S. No. 1,089,377; Mar. 3, 1914.)

**MINE-CAR WHEEL**. William H. Bines, Barnesville, Ohio, assignor of one-half to Andrew J. Baggs, Barnesville, Ohio. (U. S. No. 1,088,519; Feb. 24, 1914.)

**PROSPECTOR'S AX AND PICK**. William E. Seelye, Sault Ste. Marie, Ont. (U. S. No. 1,088,938; Mar. 3, 1914.)

**SODIUM AND POTASSIUM SALTS**—Process of Recovering Sodium and Potassium Salts from Mixtures Thereof. Clinton E. Dolbear, Berkeley, Calif., assignor to Elijah H. Merrill, Berkeley, Calif. (U. S. Nos. 1,088,216 and 1,088,333; Feb. 24, 1914.)

**TITANIFEROUS IRON ORES**, Process of Producing Yellow Pigments from. Peder Farup, Trondhjem, Norway. (U. S. No. 1,087,575; Feb. 17, 1914.)

**WIRE ROPES**—Manufacture of Wire Ropes. Ralph Thos. Skelton, Bootle, near Liverpool, England. (U. S. No. 1,088,467; Feb. 24, 1914.)

## INDUSTRIAL NEWS

The American Concentrator Co. announces it has moved its entire business from Joplin, Mo., to Springfield, Ohio.

Hardinge Conical Mill Co., 50 Church St., New York, reports an order from the Beatson Copper Co., Latouche, Alaska, for five of the largest size Hardinge conical mills.

The Terry Steam Turbine Co. announces the appointment of H. A. Rapelge as sales engineer in the Pittsburgh district, with offices at 2123 Oliver Bldg., Pittsburgh, Penn.

George A. Gallinger, of Pittsburgh, has been placed in charge of the pneumatic tool department of the Ingersoll-Rand Co. His headquarters will be at 11 Broadway, New York.

Westinghouse, Church, Kerr & Co., 37 Wall St., New York City, have established a laboratory for testing concrete aggregates, waterproofing materials; investigating paints and preservative coatings for steel and concrete.

The Joseph F. Wangler Boiler & Sheet Iron Works Co., of St. Louis, Mo., has secured a contract from the Odin Coal Co., of Odin, Ill., for two horizontal high-pressure fire-tube boilers of the Wangler type, to be installed in the early part of April.

## Editorial Correspondence

### SAN FRANCISCO—Mar. 19

**Inspection of Mines in California** is being done on a sane, practical and satisfactory basis under the direction and supervision of the U. S. Bureau of Mines and the California Industrial Accident Insurance Commission. The inspection is being conducted by H. M. Wolfin, mining engineer, of the Bureau of Mines. He has recently completed visits to the principal mines in the northern part of the Mother Lode region, beginning with the Plymouth Consolidated at the north side of Amador County and finishing with the Penn copper mine in the northwestern part of Calaveras County. The visits included the following mines: Plymouth Consolidated, Alpine, Fremont, Treasure, Bunker Hill, Original Amador, Keystone, Central Eureka, South Eureka, Kennedy, Argonaut, Zella, Hardenberg, Penn, Utica, Gold Cliff, Lightner and Angels. The mines in Shasta County will probably be the next visited, then the southern mines of the Mother Lode region, the quicksilver mines south of San Francisco, and the principal mines of southern California. Nevada and other counties of the north, where deep mining is practiced, will be visited later in the season. Wolfin, after inspecting a mine, offers to the operator or owner brief suggestions and recommendations as to the betterment of safety devices and methods of operation respecting the safety of miners. The suggestions are not issued as instructions and embrace only those things that appear to Wolfin as being of much importance. It is presumed that later the industrial accident commission will issue rules and regulations covering mining operations in California. Prior to the establishment and issuance of such regulations, or at least before they become effective, there will be provided hearings at which the operators and miners may be represented and whose objections or suggestions will be considered should they find any of the regulations unreasonable. No doubt changes will be suggested, though it is believed a thorough and satisfactory understanding between the commission and the mine operators will be reached. Such operators as have been interviewed by the "Journal" correspondent have approved the methods adopted by Wolfin. The suggestions of recommendations are typewritten and prepared for each mine separately. One operator is not aware of the recommendations made to another operator unless he may be advised by the operator himself. The law does not permit the inspector to give out any information as to what he sees or what he suggests. If the present procedure result in the permanent employment of Wolfin, or any mining engineer capable for the work, vouched for by the Bureau of Mines, and in the establishment of satisfactory regulations under the present state laws, the undertaking will be worth while. A state mine inspector holding office at the pleasure of some other state official would needs be a politician rather than an engineer.

### DENVER—Mar. 21

**A Radium Reduction Plant** as proposed by bills now before Congress, will probably be built at Denver, according to W. G. Swart, of the American Zinc Ore Separating Co., who says the prospects for such a plant for Denver are excellent. In an address to the Denver real estate exchange, he based this statement upon the geographical position of the city and the fact that every chemical required in the metallurgy of radium is manufactured here.

**Taxation of Mining Property** is a lively subject of discussion just now. The controversy between mining companies and tax assessors has crystallized in Teller County, Cripple Creek district, where suit has been filed in the district court by three companies which are taking this step in their own interest and that of 52 other companies. Upon the settlement of these three suits will depend the soundness of the law, passed at the last legislature, basing the valuation of mines on half the gross proceeds plus all the net proceeds. This purely arbitrary method of arriving at the value of property for assessment purposes is held to be unjust. The matter was discussed last autumn at the meeting of the Colorado chapter of the American Institute of Mining Engineers. Judge E. A. Colburn, as president of the Cripple Creek Mine Owners' Association, has taken the initiative in calling for a judicial opinion and, in company with Clarence C. Hamlin, personally tendered to Thomas A. Tallon, treas-

urer of Teller County, the sums that they believed fair as taxes for the Vindicator Consolidated, the Granite and the Hull City gold-mining companies. The tenders being declined, suits were immediately filed. These suits set forth that the valuation of the Vindicator mine is \$85,315 too high, while that of the Granite is \$48,798 too high. Whatever decision is rendered by the lower court, it seems certain that the cases will be carried to the state supreme court. A special meeting of the Colorado chapter was to be held Mar. 17 to decide whether the body will take steps to contest the constitutionality of the law.

### BUTTE—Mar. 18

**Chlorination of Zinc Ores** by the Northwestern Metals Co. will begin soon in the plant now practically completed at Helena. The plant has been in the course of construction during the last four years, much of the time having been consumed in experimental work. Treatment will be by chlorine gas electrolytically generated.

**Tailings From the Basin Concentrator** may be reworked. Max Atwater, former superintendent for Butte & Superior, has interested Eastern men in his plan. The concentrator at Basin was formerly owned and operated by F. A. Heinze, and afterwards operated under a lease by Butte & Superior, prior to the completion of the mill at Butte. The estimates are that between 50,000 and 100,000 tons of tailings are in the dumps which resulted from operations of Butte & Superior. On account of the imperfect methods then used in the separation of zinc they still contain much of this metal. About two years ago a number of Butte men secured a lease on the dumps and spent considerable money in the construction of an aerial tramway for conveying the tailings back to the mill, about one-third of a mile distant. Some time was spent in an attempt to treat the tailings over again at a profit, but without success, and operations stopped. By recently perfected methods of zinc concentration Atwater believes the tailings can now be profitably reworked.

**Reopening of Old Mines** in outlying districts is a subject which has lately been seriously considered by some business men of Helena, who have for some time been formulating plans for systematically reopening and developing such properties. On a large number of these mines shafts have been sunk from 100 to 500 ft. deep, and were closed many years ago, for the reason advanced by the operators, that profitable mining was no longer possible with the comparatively imperfect methods then in use for the treatment of the ores, together with high transportation costs. The Helena men take the stand that many of these old properties can be reopened and worked profitably and that many of the mine dumps formerly considered practically worthless can now be profitably treated. The plan is to raise money by subscription for the purpose of employing engineers to make examinations of abandoned mines and dumps, and already quite a large amount has been raised. The citizens propose to incorporate into one large company, and, upon the favorable report of an engineer on a property, to begin a thorough course of development.

### SALT LAKE CITY—Mar. 19

**Underground Mining Will Be Abandoned** at the Utah Copper property at Bingham within a few weeks. This statement was made after the inspection of the property Mar. 17 by President Charles M. MacNeill and D. C. Jackling. Stripping operations have been advanced making it possible for the steam shovels to mine more ore than both mills require. Connections have been made between the levels, and direct hauling can be done from all the pits. Ore can easily be broken and transported at the rate of 23,000 tons per day. At present the Magna mill is treating 14,000 tons per day, and the Arthur, 9000. During February the production amounted to 9,492,898 lb. copper, according to preliminary figures. Dividends paid to date amount to \$22,217,000.

**What Constitutes a Reasonable Attorney's Fee** was decided by Judge John A. Marshall, Mar. 18, in the case of E. B. Critchlow and W. J. Barrette against the Silver King Consolidated Mining Co., to collect for legal services in the suit against the Silver King Coalition Mines Co. Critchlow and Barrette were associate counsel for the Silver King Con-



solidated in the recently ended litigation, wherein the Consolidated company received a judgment of \$769,083, which with interest amounted to \$908,453. The case has been before the U. S. District Court for several days, and the testimony showed that there had been no specific agreement with the lawyers, other than that they should be paid a certain amount for their actual services, and a "reasonable per cent." of the judgment in the event it was favorable to the plaintiff. The lawyers claimed that a reasonable fee would be \$75,000 to \$125,000. The company offered to pay \$20,000, which was refused, and \$100,000 was deposited with the court, pending settlement. Other lawyers employed by the Consolidated had been previously settled with. A number of lawyers testified for the plaintiffs that in their opinion 7½% of the judgment would be a reasonable fee, and lawyers for the defense testified that a reasonable fee in the case would be between \$50,000 and \$60,000. Judge Marshall decided that 7½%, or \$68,133 should be paid.

#### BRAINERD—Mar. 21

**Electricity in Mining on the Cuyuna** will play an important part. Providing first its Armour No. 2 property with electrical underground and surface trammings systems, the Rogers-Brown Ore Co. supplied its Kennedy mine with similar equipment. The power is procured from the company's own plants. Electricity furnished by the Cuyuna Range Power Co. operates much of the machinery at the Rowe open-pit mine of the Pittsburgh Steel Ore Co. Power from the same source will, under a contract recently awarded, drive a 2000-gal. pump at the Armour No. 2. Electrical equipment will be installed at the Wilcox mine of the Canadian Cuyuna Ore Co. at Woodrow, the newly platted town six miles east of Brainerd. The Armour No. 2 now has in stock nearly 100,000 tons of ore; the Kennedy has a pile approximating 60,000 tons. Both mines will ship briskly throughout the season. The stockpile at M. A. Hanna & Co.'s Barrows mine is attaining considerable proportions. The Barrows shipped 9000 tons in 1913; the output this year will be much greater. The Adams, a property which Cuyler Adams and associates are developing at Orelands, also is stockpiling. So are the Ironton of the Cuyuna-Duluth company and the Cuyuna-Mille Lacs mine near Iron Mountain. The Duluth-Brainerd, west of Iron Mountain, is sinking a shaft and will do some shipping this year. The Iron Mountain mine, near Manganese, is a prospective producer for 1914. The Brainerd-Cuyuna company is sinking a second shaft on its property within the city limits of Brainerd. Open-pit operations are in progress at the Pennington mine of Tod, Stambaugh & Co., the Thompson of the Inland Steel Co. and the Rowe property. All three are expected to be heavy producers this year.

#### JOPLIN—Mar. 21

**Coöperative Prospecting Companies** have always been popular in the Joplin district but an innovation in operation has just been introduced through the joining of the Aurora citizens with the American Zinc, Lead & Smelting Co. in a drilling campaign in which about \$5000 worth of work will be done. The mining company proposed to Aurora citizens that it stood ready to cover any amount the citizens would subscribe with a like amount, the whole to be expended by the company in thoroughly drilling a number of mining tracts lying in that camp. The citizens accepted the proposition and last week subscribed \$2500 to start the work. This fund will be sufficient to do 5000 ft. of prospect drilling or 25 holes 200 ft. deep. This depth or at most not over 300 ft. is amply sufficient to test out the ground for profitable orebodies in that camp and if care is taken in selecting the ground to be tested the citizens committee anticipates some ore strikes of importance. The new work is important to Aurora because for a number of years mining activity has been waning. During 1899 and for a number of years after, this camp in the extreme eastern end of the district was one of the most active and one of the most productive, especially of zinc-silicate ores. The working out of the main runs of the first discovery discouraged further prospecting and there has been little mining of importance for the last four or five years.

**Congressional Industrial Relations Committee** represented by W. J. Stowell, a field investigator for the committee, has just undertaken a survey in the Joplin district and will be engaged in the work for the next 30 days. Stowell will undertake to investigate relations of miners and employers, health conditions, unions, wages and kindred subjects. He arrived just when the Joplin business men were engaged in investigating and making reports upon the conditions prevailing in the mines which has resulted in such a plague of miners phthisis in the field. The statistics for 1913 had just been reported by State Mine Inspector I. L. Burch and were a surprise to the best informed men in the field. It appears that of the 8000 men working in the Joplin district mines in 1913,

72 died of tuberculosis that year or a death toll of 0.9%. These conditions are receiving the attention now of both mining men and civic workers and a campaign of education is being undertaken to get the miners to take greater precautions and care of themselves. The greatest evil is recognized in the rock dust and some operators have installed sprinkling devices and apparatus for preventing dust and they have found their men unwilling to use them. The problem for improvement lies therefore both in installing the apparatus generally and in educating the miners to coöperate in using it and all other sanitary devices provided against the spread of disease.

#### FREEPORT, TEXAS—Mar. 17

**Freeport Sulphur Co.** construction work now underway will cost \$150,000 and will result in increasing the sulphur production at Texas' only sulphur field, now being developed. Rapid progress has been made during the last month. The concrete foundations for the battery of boilers rated at 8000 hp., part of the new mining unit to be used for the production of superheated water, by which the sulphur is mined "in place," have been completed. Work on the foundations for the pumps and other machinery comprising the new plant is well under way and rapidly nearing completion. Machinery, weighing 600 tons, comprising boilers, pumps and structural steel to be used in the construction of the new fireproof plant arrived last week from New York on the steamer "Kennebec" and is being moved by rail to the mines. Installation of the boilers and pumps and the erection of the building to house the plant will begin during the next 10 days. When completed this will make the second superheated-water unit installed at the Freeport sulphur field, and is in line with the policy of the company to build one unit after another as fast as practicable. The doubling of the capacity of the plant at the mines whereby an increased supply of superheated water may be forced into the sulphur formation to melt out the mineral so it may be pumped to the surface will actually mean more than doubling the output as has been found by experience. Steady shipments of sulphur have been going by rail to the eastern and northern markets ever since the first of the year, and Texas sulphur is meeting with marked favor with paper manufacturers and chemical buyers who have purchased the Freeport product. The first shipload of sulphur from the local mines is scheduled to leave this port on the steamer "Honduras" of the Seaboard & Gulf Steamship Co.'s line early in April.

#### TORONTO—Mar. 21

**Protests Against Iron Subsidies** have been made by representatives of 120 agricultural societies. A resolution against government assistance by either the Dominion or Provincial governments to the iron and steel industries or to iron mining was passed for presentation to the Dominion Government. Farmers appear to be united against any further bounties to the iron or steel industry. This action is the result of the recent activity of the Associated Ontario Boards of Trade and other interests who are asking for a bounty on iron ore mined and shipped from Canadian mines.

#### SOUTH PORCUPINE—Mar. 21

**Purchase Negotiations for the Jupiter** by the McKinley-Darragh company of Cobalt have been completed. According to the terms of the deal, a new company with a capitalization of \$2,000,000 which is the same as the present capitalization, will be formed to take over the assets of the Jupiter mine. The present shareholders will receive one share of the stock in the new company for every two shares turned in. This will leave 1,000,000 shares in the treasury to be taken by the McKinley-Darragh company at a price of 12c. per share. The purchasers agree to spend \$30,000 by Aug. 1 in developing the property and should this development be satisfactory, they will then pay off the \$50,000 bond issue and provide additional working capital to the amount of \$40,000. Many of the Jupiter shareholders appear to be dissatisfied with this deal and there has been a sharp drop in the market value of the stock.

#### COBALT—Mar. 21

**Vote on Cobalt Amalgamation** by the shareholders of the City of Cobalt, Cobalt Townsite, Cobalt Lake and Townsite-Extension companies, resulted in a large majority in favor of the consolidation of these properties. Shareholders of the Cobalt Townsite company, however, were by no means favorably disposed to the scheme as they seemed to feel that the new company proposes to pay an excessively high price for some of the other properties. The new concern will be under the chairmanship of Sir Henry Pellat, of Toronto. The properties acquired were valued at £1,600,000 and the net annual income is estimated at 17%.

# The Mining News

## ALASKA

**KENAI PLACERS**—James R. Hyden, a mining man of Kenai peninsula, who has been getting options on Kenai River dredging ground, announces that his deal is practically completed. Hyden, representing a group of dredging men, has secured options from original owners, on a basis of starting a crew of men to work at once to prospect ground. Purchase price per acre or 20-acre claim will be determined by amount of gold in ground so tested and is to be paid to owners as it is extracted with certain guaranteed payments. Hyden has under option all claims on both sides of the Kenai from the disputed ground to the cañon, a little more than 2000 acres of possible dredging ground. Drillers will be put to work in early spring.

**MINING MEN BOUND FOR THE NORTH** sailed on the Admiral line steamer "Admiral Sampson," which left Seattle Mar. 15. In party are operators, prospectors and mining crews bound for the gold fields of Chisana, Thunder Creek, near Mount McKinley, Iditarod and copper mines near Chitina. A. H. Fay, of the Bureau of Mines, was also a passenger bound for Knik and Matanuska coal fields. He states that steam coal from that field, mined by the Government and brought to tide water early this summer, will be given a fair test by the War Department as soon as fuel can be made available. Disputes between working forces in Matanuska district, and in which Jack Dalton, the pathfinder of Alaska, figured conspicuously, have been settled.

**PROSPECTS AT CHISANA**, states D. W. Stacey, a prospector who reached Victoria, Mar. 12, from the north, are good for those who arrived early, but that district has been over-boomed. There were only eight men ahead of the party that Stacey accompanied to diggings, so having reached there before real rush commenced they were able to secure some good locations. Stacey, being one of the original locators, feels that it is important that outside public should be made acquainted with conditions. He does not wish to be understood as "knocking," but says that Chisana as yet gives promise of being nothing more than a first-class small placer camp. Of many claims staked, only sixteen have been subjected to a thorough investigation. Others may prove valuable on development. For experienced prospectors, with time to go over adjoining territory, he does not think there is a better opportunity than that afforded by Chisana.

**RAMSAY-RUTHERFORD (Valdez)**—A five-stamp mill, three Foos engines, and other equipment is being installed.

**GOLD KING (Valdez)**—A shipment of machinery and equipment has been made to this property at Shoups Bay, among which is a set of crushing rolls and an electric-lighting plant.

**SKEEN-LECHNER (Seward)**—Roller mill has been ordered for this property near Seward, and will be shipped in at an early date and taken in over the snow.

**TASUNA GOLD CO.**—Company has been incorporated in Seattle for \$750,000; S. I. Silverman, secretary and manager. Property to be developed is on Tasuna River, and consists of four claims. Development work will start at once.

## ARIZONA

### Maricopa County

**HASSAYAMPA MINING & EXPLORATION CO. (Wickenburg)**—Large shoot of good milling ore has been opened in shaft, which is 150 ft. deep.

**RED ROVER (Phoenix)**—A gasoline hoist has been installed and development has been commenced. As soon as water is under control, sinking will be resumed.

**SMITH'S MILL (Morristown)**—Tailings dump on Hassayampa has been purchased and treatment of tailings with cyanide will be commenced at once. Many tons of ore from Vulture mine were crushed at Smith's mill. A cyanide plant was built several years ago and a good cleanup made.

### Yavapai County

**CLEOPATRA COPPER CO. (Jerome)**—A few men are at work in long tunnel.

**ARKANSAS & ARIZONA (Jerome)**—Company has decided to sink to 2000-ft. level. Shaft is now more than 1500 ft. deep.

**CALUMET & JEROME COPPER CO. (Jerome)**—Development is proceeding slowly, two men being employed to drive tunnel, which is now in 917 ft. Tunnel is being driven to cut a vein encountered in shaft 500 ft. higher up hill.

**UNITED VERDE EXTENSION (Jerome)**—New shaft is nearly 1000 ft. deep, and Douglas-Tener syndicate, which is prospecting this property, expects to be cutting station for twelfth level, which is 1000 ft. below collar of new shaft, by Apr. 1. From old Daisy shaft, which is 769 ft. deep, prospecting has been done on 1000-ft. level through a winze. A cross-cut driven directly toward fault, ended in soft iron-stained schist and shattered quartz; a crosscut in a northwesterly direction cut fault without any quartz being found. It was decided to sink 400 ft. deeper and crosscut country on that level. About 2700 ft. of development has been done, and syndicate still has over \$50,000 left with which to drift and crosscut under quartz and copper-stained decomposed schist.

## CALIFORNIA

### Amador County

**DEFENDER (Defender)**—Metallurgical experiments are in progress to discover best method of saving gold. Stamps and rollers have been employed both separately and combined; but recovery has not proved satisfactory, as there is still a large discrepancy between assay and mill run. A large amount of ore has recently been shipped to Jackson for determination at McCarthy assaying and sampling plant. Defender is one of the worth-while properties of East belt of Mother Lode region that has character and quantity of ore that should make it a paying producer.

### Shasta County

**SILVER KING (Redding, Manager E. J. Barnes, Seattle)**—Mine has been closed down after eight months' development under bond. It is supposed time of option was not sufficient to satisfy investors. Property is four miles west of Redding. Ore carries silver and copper.

**MIDNIGHT (French Gulch)**—New 5-stamp mill to be installed, to crush ore from this mine and adjoining claims being developed. Midnight is on Mule Mountain, and was recently discovered. It is believed that high-grade ore will prove to come from a well defined vein and not a pocket.

**MIDAS MINING CO. (Knob, Harrison Gulch district)**—New 100-ton cyanide plant and tube mill is in commission and reported to be working satisfactorily. Ore is crushed in a 20-stamp mill. Midas is an old producer and introduction of cyanidation is in line with progressive methods adopted.

**BALAKLALA (Coram)**—It is reported that option on Hall desulphurizing process has been extended three months from end of March. Tests made have been encouraging. Since change made from oil burners after installation of gas plant, experiments have been largely with use of oil as fuel. Experiments will now be chiefly with gas. Improvements are also being made with washing machinery.

### Tuolumne County

**NEW CYANIDE MILL** is being built near Harvard mine by W. H. Staver, formerly with Liberty Bell mine in Colorado. Experiments in treating concentrates from mines in vicinity of Jamestown will be undertaken.

**LONGFELLOW (Big Oak Flat)**—Mill has been running on good ore for last month.

**EAGLE-SHAWMUT (Shawmut)**—Electric motor and new ore cars have been received. Enlarging of old tunnel to accommodate larger cars to be hauled by electricity is nearing completion.

**UNITED MINES (Sonora)**—F. M. Nugent, Paul Morris and D. Lumstead, developing for two years under lease, have recently completed repair work and expect to put 20-stamp mill in commission soon.

## COLORADO

### Clear Creek County

**READY CASH MINE (Empire)**—Lessees have drifted for a distance of 30 ft. on a 4-in. streak of ruby silver ore.

**QUITO (Idaho Springs)**—Thomas Johnson has secured a lease on this property and will resume development thereon in near future.

**FIREMAN'S & CONDUCTOR'S MINE (Idaho Springs)**—Property is being developed under lease by H. J. Theide. A drift on Lucky Boy vein has opened milling ore 6 ft. wide, from which shipments are now being made.

**CROWN PRINCE CONSOLIDATED MINING CO. (Empire, Colo.)**—Manager William Krape has awarded a contract to lift a raise from tunnel level of Mint mine to surface. As soon as raise is completed an electric hoist will be installed. Main heading on Mint vein will be advanced.

**VINDICATOR MINING CO. (Idaho Springs)**—Ore on Tom Tuck vein in Gold Hill, up Chicago Creek, is being developed. Vein was intersected by a 300-ft. crosscut tunnel and has been opened for a distance of 50 ft. Vein is reported payable over a width of 5 ft. and contains stringers of sulphide ore assaying high in gold. Drifting on vein will continue. Stopping will commence in near future and a mill-run will be made in a local mill.

**IDAHO-BRIDE LEASING CO. (Idaho Springs)**—Company is shipping ore to both Combination and Newton mills, in Idaho Springs. Recent underground developments have been very encouraging. Milling ore concentrates 3.5:1. Lead concentrates assay 0.45 oz. gold, 25 oz. silver, and 45% lead. Iron concentrates assay 0.7 oz. gold, 35 oz. silver, 10% zinc, and 1% copper. A zinc product has been made which assays 0.5 oz. gold, 35 oz. silver, 2% copper, and 24% zinc.

**GEM (Idaho Springs)**—Several Waugh drills, manufactured by Denver Rock Drill Co., are being used. Twelve sets of lessees are at work, employing altogether about 50 men. Some of these lessees are doing development work and most of them are shipping. Mosher lease on twelfth level west heading has opened a 2-ft. vein of sylvanite ore, which shows native gold. Shaffer lease, on 100-ft. level east heading, has been developing a 2-ft. vein of shipping ore for several months. This vein now shows an 8-in. streak of material, which assays \$100.



**Gilpin County**

**WAR DANCE MINING CO.** (Central City)—Company's property, which attracted attention a few years ago on account of its production of high-grade gold-bearing marcasite, has been reopened and development will be undertaken. Machinery recently installed includes a six-drill air compressor, a 30-hp. hoist, and a pump. Mine is on south side of Russell Gulch, near boundary line between Gilpin and Clear Creek Counties.

**San Juan Region**

**PRIMOS CHEMICAL CO.** (Vanadium)—Company contemplates an increase in its milling capacity from 90 to 180 tons per day. Additional teams will be placed in service on wagon road between mine and mill.

**CARBONERO MINING CO.** (Ophir)—Additional men are being employed on development. Shooftly tunnel, which is now 2500 ft. long, will be advanced another 500 ft. to intersect Carbonero vein. Crosscut recently intersected Mohawk vein.

**CIMARRON** (Telluride)—Development is progressing favorably in upper level. A large quantity of good milling ore has been opened. As soon as water is available for milling purposes tram will be extended to upper level, so that ore may be treated in Cimarron mill.

**BLACK BEAR MINING CO.** (Telluride)—A force has been employed in cleaning out this property in Ingram Basin preparatory to resumption of operations during coming season. Before end of summer it is estimated that company will be employing from 75 to 100 men.

**Teller County**

**BLUE BIRD** (Independence)—A new strike has been reported, made on 1400-ft. level.

**JO DANDY** (Cripple Creek)—Charles Ridpath, superintendent, died Mar. 13. Thomas Smith, of Cripple Creek, has been appointed his successor.

**AJAX** (Victor)—Company has leased Coriolanus, on adjoining property, and has made an underground connection, so that property may be worked through Ajax shaft.

**IDAHO****Coeur d'Alene District**

**SNOWSTORM** (Mullan)—Following recent acquisition of 800,000 shares of Missoula stock, by Snowstorm company, Greenough interests have acquired Tuesday group of claims, consisting of Tuesday No. 1, Tuesday No. 2, Tuesday No. 3 and Tuesday No. 4, near Missoula, National Copper and Lucky Calumet properties. Group lies south and east of Missoula and north of Lucky Calumet, Olive and Rose claims, joining on north and Missoula and Lost Horse claims on west, while Lucky Friday and Setting Sun claims join them on south. Acquired ground practically joins Snowstorm on south and will permit extension of latter's long lower tunnel through four claims directly into Missoula ground without passing through Snowstorm and Lucky Calumet. Conveyance has been recorded at Wallace to Leo Greenough, manager for Snowstorm company, from George A. Gaumont, Sr., George A. Gaumont, Jr., and Lawrence J. Bischel, of Burke. No notice of location of any such claims is recorded and it is presumed that locations are of recent date, and time for recording notices, 90 days after date of location, has not expired. It was generally believed that no vacant ground existed in such close proximity to these well known properties. Acquisition of these properties gives rise to belief that Snowstorm intends to extend its workings farther into mountain and in so doing will be able to crosscut three copper veins, which are said to traverse that district, Missoula being on north vein, National Copper on center and Lucky Calumet on south veins.

**MINNESOTA****Cuyuna Range**

**DELL DEVELOPMENT CO.**—Individual stockholders in this company, organized to exploit Jones "step process" as applied to Cuyuna manganiferous iron ores, are now defendants in a suit brought by Stowell Exploration Co. to recover several thousand dollars due for diamond and churn drilling done for company. All options have been dropped, and company is apparently defunct.

**Mesabi Range**

**GREAT WESTERN** (Virginia)—It is reported that this property will soon be opened as an underground operation. It is controlled by Oliver Iron Mining Co., and adjoins Auburn mine, midway between Virginia and Eveleth. Sinking of a shaft will start soon.

**HAWKINS MINING CO.**—Ditch around O'Brien Lake, near Nashauk, Minn., has been completed, after seven months' work with one steam shovel, during which time 100 men were employed. Ditch is 15 ft. wide at bottom and 30 ft. wide at top, extending about two miles around lake. It was built to clarify water used in iron-ore concentrating plant.

**SECTION FOUR MINING CO.** (Eveleth)—A considerable tonnage is expected from this property this season. Property is on Ely Lake, two miles from Eveleth; 150 men are to be put to work underground at once. Shafts are already in ore and a small daily production has been made for some time past. Another part of the property has been stripped for pit operations. Duluth, Missabe & Northern Ry. is building a spur to property.

**MADRID** (Virginia)—Eureka Ore Co., capitalization \$50,000, was recently organized by H. O. Johnson, Harry Osterberg and others, of Virginia, Minn., to operate this mine, lease of which was recently surrendered by A. E. Coates. Surface and underground equipment has been purchased, and it is planned to remove remaining ore, of which there is not much, before removing machinery to other properties. Then it is planned to use surface material stripped from near-by properties to fill caved portions of property and place it in proper condition for dwelling sites. As tract is well situated in city of Virginia, move is considered a good one.

**MISSOURI-KANSAS-OKLAHOMA****Joplin District**

**JOHN HALL** (Lawton—via Weir, Kan.)—In sinking shaft, good run of zinc ore was recently found from 130- to 148-ft. level.

**DILLARD & CO.** (Aurora, Mo.)—New shaft is at 59-ft. level. Operators are sinking to reach drift in old shaft where lead vein exists.

**PEDAGOGUE MINING CO.** (Joplin, Mo.)—Property is rapidly developing into good producer; high face of lead and zinc found in drifts. Mine is on Missouri Lead & Zinc Co.'s land.

**CARNEGIE** (Spring City, Mo.)—At this mine, on Sunrise tract, operated by Frank Wilson and associates, rich face of zinc ore was encountered at 80-ft. level. Ore is said to run 10% blende.

**MARSHAL & CO.** (Wentworth, Mo.)—Bluebell mine, year ago a good producer, has been taken over by this company, operating as the Jack Possum. Alice Dayton mine also may be leased by company.

**EASTERN LEAD & ZINC CO.** (Lawton—via Weir, Kan.)—Ore has been found by drilling east of concentrator. Blende found at 18-ft. level, continuing to depth of 85 ft. Indications are that deposit is large.

**CRAZY SIX MINING CO.** (Thoms Station, Mo.)—Home Development Co.'s mine has been taken over by this company and operations are in progress. New veins have been reached. Ore is trammed to Betsey Jane concentrator.

**CO-OPERATIVE MINING CO.** (Joplin, Mo.)—Company has made two good strikes on 80-acre tract on Schiefferdecker land by drilling. Other holes are to be put down. Discovery is near Falls City, Martha Ball and other mines.

**CHARLES COX & CO.** (Joplin, Mo.)—New prospect has been opened near old John Jackson mine on Chicago-Joplin tract at Chitwood. Shaft now at 125-ft. level, with ore from 80-ft. level. A few years ago John Jackson was greatest producer in Joplin, more than \$1,000,000 worth of ore having been produced.

**MONTANA****Fergus County**

**BARNES-KING DEVELOPMENT CO.** (Kendall)—According to report covering operations at Kendall properties of company for February, 424 tons of ore were mined and milled, for 2619 oz. of gold, which netted \$45,649, or \$10.32 per ton.

**Jefferson County**

**MONTANA-ILLINOIS MINING CO.**—Contract for additional development work at Bismarck mine, on Little Boulder, in form of a raise to be driven from middle tunnel to tunnel No. 2, a distance of 200 ft., has been let. Raise will be driven on orebody and be for ventilation as well as development purposes, and is expected to be completed by time mill is started in spring.

**Silver Bow County**

**BULLWHACKER** (Butte)—Mine and mill of this company, which had been shut down for a week in order to make some changes, resumed operations Mar. 15.

**ANACONDA COPPER MINING CO.** (Butte)—C. W. Goodale has been placed at head of new "safety" department. He has left for the East, where he is to visit Steel Corporation and other plants and mines to make a study of safety devices used in the places visited.

**CORBIN COPPER CO.** (Butte)—Work on Gambrinus, in west-side residence district of Butte, was suspended a few weeks ago, pending arrangement for a loan of \$75,000 to make final payment on property. Loan was recently secured from U. S. Smelting, Refining & Mining Co., giving Corbin company three years in which to return money. Upon collection of back assessments, amounting to \$60,000, company will be in position to resume work and it is contemplated to sink shaft to 800-ft. level to develop Belcher vein.

**DAVIS-DALY COPPER CO.** (Butte)—Rumors that mines of this company might be shut down, at least temporarily, have been circulated for several days, having their origin in fact that output from these mines has been steadily reduced recently so that at present only 150 tons of ore are hoisted per day as against a normal 300 tons per day. It has also been rumored that management was considering a change in power for hoisting at Colorado shaft and to make other important improvements. According to statements of company's officials, no definite action regarding these changes has been decided upon as yet and no shut-down is planned for immediate future.

**BUTTE MINERS' UNION** (Butte)—A delegation of the union attended a meeting of Butte Chamber of Commerce held recently, to enlist members of that organization in a campaign for a reduction of living costs. The miners' grievances aroused a lively discussion of many subjects bearing on high scale of wages demanded by other Butte labor unions to which miners' union has lent its moral support, and which, so other side claims, is largely responsible for high cost of rentals and commodities. It was finally decided that miners' union and Chamber of Commerce appoint committees to hold joint sessions in near future to discuss ways and means for adjusting these matters.

**BUTTE-DULUTH MINING CO.** (Butte)—Announcement is made by Captain Wolvin that capacity of plant, which was originally planned for 1000 tons per day, is to be 3000 tons. This was determined upon finding that it could be accomplished by a very small additional expense. Change was authorized and all plans for crushing, leaching and electrolytic plant have been revised accordingly. During February 316 tons of ore, containing 2.11% copper, were mined and milled at a total cost of \$2.49 per ton; 64,521 lb. of electrolytic and 30,000 lb. of cement copper were produced at a net cost of 8½¢. per lb. Among latest improvements planned is installation of a Kelly filter press and a conveyor to carry tailings to dump, which work now requires an extra man, horses and loading of tailings into cars.

**NEVADA**  
**Clark County**

**COLUMBIA (Goodsprings)**—Installation of new gasoline hoist and cable tramway is completed and company is shipping several cars of copper-gold ore each month.

**SOUTH NEVADA (Las Vegas)**—Company has been operating its new 100-ton amalgamation plant for last few weeks, and it is stated that an \$8000 brick has been sent to assay office. It is reported that company contemplates enlarging plant at once.

**ANCHOR (Goodsprings)**—Since first of year, this property has maintained steady shipments of mixed lead-zinc-carbonate ore to Wisconsin plants, ore being hauled by wagon eight miles to Jean. It is stated that company contemplates using motor trucks for haulage.

**MILFORD (Goodsprings)**—Cressman & Depue, of Los Angeles, have leased this property from H. J. Jarman, who has it under bond and have announced that a 50-ton mill, using Stebbins dry concentrating process, will be erected at once. Ore, of which there is a considerable tonnage blocked in mine, is a mixed lead-zinc carbonate, and tests have proved that it responds readily to dry process. It is expected that motor trucks will be used for haulage after plant is in operation as property is situated about 18 miles from railroad.

**BOSS GOLD MINING CO. (Goodsprings)**—Company has recently been organized to operate property, in which there is a considerable tonnage of gold and copper ore already blocked out. Orders have been placed for a cable tramway, which is to be constructed from mine to wagon road, and shipments of copper-carbonate ore will commence in near future. Cyanide tests have been made on gold ore, which is separate from copper ore, and it is probable that a small cyanide test plant will be erected in near future.

**YELLOW PINE (Goodsprings)**—Installation of a new power plant and electric hoist at mine is complete and new two-compartment shaft has reached a depth of 375 ft. It is expected that oreshoot will be intersected by new shaft at a depth of 700 ft. Pending completion of new shaft, which will greatly lessen cost of hoisting ore, no ore is being mined, but company is operating mill two shifts on low-grade ore from dumps and fills. It is expected that full operations will be resumed in May. Company is now paying a monthly dividend of 1c. per share, amounting to \$10,000.

**Douglas County**

**MINNESOTA-NEVADA COPPER MINES CO. (Yerington)**—Tests on iron ore from this company's mine, in Churchill cañon, 16 miles west of Yerington, will be made to determine its suitability for manufacture of pig iron.

**Esmeralda County**

**HASBROUCK (Gold Mountain)**—Ore bins have been completed and 40-hp. hoist has been installed. First lot of ore is ready for shipment. Development work consists of a crosscut 500 ft. long, drifts on vein and shaft 500 ft. deep. Large tonnage of good-grade ore has been developed. Roads will be built to Tonopah & Goldfield R.R. at point between McLean's and Klondike, where siding will be put in. There is considerable mining activity, it is stated, in Gold Mountain district.

**Humboldt County**

**BIG FOUR (Rochester)**—Mining is retarded by bad condition of roads which prevents shipments being made. Stopes are full, 3000 tons being ready for shipping.

**ROCHESTER MINES CO. (Rochester)**—Decision has been given in favor of plaintiffs in suit against Joseph Nenzel for recovery of stock, awarding them 210,000 shares. Case may be appealed.

**SEVEN TROUGHS COALITION (Seven Troughs)**—Mill has been started and is treating ore from new shoot below tenth level. Canvas table has been installed to separate fine sulphides from sands after passing concentrating tables. Station is being cut on 140-ft. level of No. 4 winze preparatory to north and south drifting.

**Lincoln County**

**SHIPMENTS FROM PIOCHE** are being made by Half Moon, Manhattan Lease, and Culverwell & Orr.

**ALPS (Pioche)**—It is stated that this property has been sold to Portland, Ore., men.

**AMALGAMATED PIOCHE (Pioche)**—No. 1 shaft is now 1400 ft. deep. When it is deep enough for sump, station will be cut and crosscut driven on 1400-ft. level.

**VIRGINIA-LOUISE MINING CO. (Pioche)**—Production will be resumed soon. New shoots of good-grade ore have been developed. Property adjoins Pioche Consolidated.

**Lyon County**

**YERINGTON-BULLION (Yerington)**—Development work has been resumed.

**YERINGTON MINES & EXPLORATION CO. (Yerington)**—A portion of this company's holdings has been taken under bond by Miami Copper Co.

**COPPER GIANT (Buckskin)**—Lease and bond has been taken on this property west of Mickey Pass. Oxide and sulphide copper ores are exposed in development work.

**BOVARD (Yerington)**—High-grade gold ore, it is reported, was discovered recently in this property in Pumpkin Hollow. Discovery was made in crosscut driven from old shaft.

**MASON VALLEY MINES CO. (Thompson)**—Ore receipts for month ended Feb. 28, 1914, were as follows: From Mason Valley mine, 6324 tons; from Nevada-Douglas, 2942 tons; other mines, 2421 tons; total, 11,687, or a daily average of 417 tons. During same period 13 cars of blister copper were shipped. Number of claims west of Empire-Nevada and South of Montana-Yerington have been taken up recently. Options have been secured on Copper Stone, Sunday, Dickey and Carson groups in Mason Pass. It is reported that churn drilling will be done on all this ground.

**Nye County**

**NORTH STAR (Tonopah)**—Downward extension of McDonald vein has been cut by raise from 1200-ft. level.

**COMMERCIAL MINES & MILLING CO. (Manhattan)**—War Eagle mill, recently enlarged, will soon be operating at full capacity, it is stated. Tramway from Mustang Hill has greatly reduced expenses.

**Storey County**

**BELCHER (Virginia City)**—A two-compartment raise has been started in large quartz shoot on 1500-ft. level. This level has been drained and reopened for development after being flooded for 30 years.

**OPHIR (Virginia City)**—It is now believed that ore found on 2350-ft. level is Hardy vein, fissure having taken course and strike of that producer on 2000, 2100 and 2200 levels. Cars samples show ore to assay from \$38 to \$45 per ton. East vein on this level is showing increasing width. Milling operations by company will be resumed, \$10,000 worth of ore having accumulated in development work, with over 40 ft. of ore blocked out.

**Washoe County**

**GRANITE HILL MINE (Reno)**—Ore is being hoisted at this mine, in Granite Mountain district, through old vertical shaft. New 5x9-ft. incline shaft is just being completed, and 25-hp. hoist is being installed; drifting on 125-ft. Boarding house, bunk house and blacksmith shop have been built. Other properties being worked in this district are, North Star, Mascot, State Line and Rice.

**White Pine County**

**GOLD-SILVER STRIKE SOUTH OF PIEDMONT**, it is reported, has been made on east slope of Shell Creek range.

**HAMILTON POWER, TRANSPORTATION & MINING CO. (Hamilton)**—Shipments have been made steadily all winter. It is planned to use auto trucks for ore haulage about May 1.

**NEW MEXICO**

**Grant County**

**EIGHTY-FIVE (Lordsburg)**—Company is building mill to treat its own ores. Production is now 4000 tons per month.

**C. & O. (Pinos Altos)**—Explosion of powder and gasoline in shaft house demolished building and equipment. Work will be commenced on reconstruction at once.

**AMALGAMATED LEAD & SMELTER CO. (Lordsburg)**—Company has taken over Metropolitan property from J. C. Waldeman and associates, of San Francisco. Large tonnage of lead-silver and copper ore is blocked out. There are reports of a concentrator being built.

**Otero County**

**GARNET (Oro Grande)**—Shipments are now 150 tons of copper ore weekly to El Paso smelting works and 100 tons iron ore daily to Pueblo, Colo.

**San Miguel County**

**ROMERO MINING CO. (El Porvenir)**—A strike of uranium and vanadium ore is reported to have been made in drifting at depth of 180 ft.

**OREGON**

**Baker County**

**NORTH POLE (Sumpter)**—This mine, which has been idle for over two years, has been reopened under direction of Ralph Clark, who is planning considerable new work.

**Josephine County**

**ORIOLE (Metalline)**—New machinery is now ready for operation, and work will be started at once taking out large body of ore that is blocked out, some of which assays as high as \$100 per ton.

**BEAVER PORTLAND CEMENT CO. (Grants Pass)**—Plant, which will manufacture cement from the limestone found near Gold Hill, is nearly completed, and will soon be in steady operation. It is equipped with modern machinery, and represents a large investment.

**SOUTH DAKOTA**

**Lawrence County**

**IDEAL WEATHER CONDITIONS**, with almost no snow-fall and but one or two days of zero weather, were features of season up to Mar. 10. Since then over 1 ft. of snow has fallen, assuring good supply of water.

**CUSTER PEAK (Roubaix)**—Diamond drilling on this copper property, from bottom of 250-ft. shaft, is contemplated. J. H. O'Brien is manager.

**WASP NO. 2 (Flatiron)**—Last two or three weeks property has been operating full capacity, 500 tons daily, for first time since work was resumed Jan. 1.

**ORO HONDO (Lead)**—Three shifts are working in de-watering workings, using two 600-gal. skips. Present progress indicates all water will be out by Apr. 1.

**KALEVA MINING CO. (Lead)**—Company has been granted, by state securities commission, under blue-sky law, right to sell treasury stock in this state. Property is in Custer Peak district, and it is probable small milling plant will be built this year.

**NEW RELIANCE (Trojan)**—Dam to impound tailings and prevent pollution of Spearfish Creek is being replaced by new structure larger and stronger than old. It will be 150 ft. long, crossing steep gulch, 40 ft. high at highest point. Bill of material calls for about 20,000 ft. of lumber and 5000 to 6000 running feet of timbers.

**BISMARCK (Flatiron)**—Ore supply going to mill at rate of 300 tons daily, has for several weeks past showed an average value of \$1.72 per ton. Extraction, by coarse crushing and direct leaching, is 80%. Some assays of tailings show as low as 21c. per ton, which would indicate 88% extraction. On this basis property is earning small profit.



## TENNESSEE

## Polk County

TENNESSEE COPPER CO. (Copper Hill)—Plans are being made to increase the producing capacity of the mines by 1000 tons daily, which will enable carrying a larger stock of ore on surface. Two furnaces are to be enlarged and one more furnace is to be connected with the acid plant so for the latter part of the year there will be an increase of both mining and smelting capacity.

## UTAH

## Beaver County

CUPRIC (Newhouse)—Development work is being done, and ore carrying lead and copper mined. Shaft is down 412 ft., and machinery is being installed.

SOUTH UTAH (Newhouse)—Mill is being run steadily, producing 1½ cars of concentrates daily; production for March will show an increase over that of February. Several cars of crude ore will be shipped during March.

MAJESTIC (Milford)—Annual report shows that 15,542 tons of ore were produced during 1913. Cash on hand at beginning of 1914 amounted to \$37,781, which is greater than for year preceding. Miners' Smelting Co. settled suit with Majestic by payment of \$21,000 in cash to that company. Old Hickory mine shipped 14,542 tons of ore. At Hoosier Boy a new shaft was sunk 200 ft., and this will be continued 200 ft. further. Arrangements for installing electric power are being made at latter property.

## Juab County

COLORADO (Silver City)—There are considerable deposits of low-grade ore bordering former high-grade ore-bodies.

MAY DAY (Eureka)—Two cars of silver-lead ore of good grade have recently been shipped by Mitchell-Kitt lease. Ore has been opened for 46 feet.

VICTORIA (Eureka)—A shipment of gold ore from 900- and 1000-ft. levels has been made. Lead ore is being developed in a raise from 1200.

LOWER MAMMOTH (Mammoth)—Copper-silver ore is being mined from 1800 level. Development is in progress on 1500 and 1600. Operations by Gold Chain through Lower Mammoth have been discontinued.

UNCLE SAM (Eureka)—Three cars have been shipped by lessees, ore being taken out by way of Beck tunnel, and sent over Knight railroad over to sampler at Silver City. Other shipments by lessees are awaiting a better condition of roads, there being at present much snow.

## Salt Lake County

SOUTH HECLA (Alta)—Ore is being shipped from this property on sleighs.

EMMA COPPER (Alta)—A lease has been taken by Hans Wunder, who will start work shortly.

UTAH COPPER (Bingham)—The hearing in case of judgment of \$29,000 refund in taxes given company, and appealed by Salt Lake County, will be heard May 11 by circuit court of appeals at St. Louis.

MICHIGAN-UTAH (Alta)—Cliff Mining Co., which is leasing ground above Cleaves tunnel is shipping via tram to Tanner's Flat, and from there by team to Wasatch. Several hundred tons of medium-grade ore have been broken.

## Summit County

PARK CITY SHIPMENTS for week ended Mar. 6 were 2,704,360 lb.; those for that ended Mar. 13 were 2,370,340 lb. by Silver King Coalition, Daly-Judge and Silver King Consolidated.

MINES OPERATING CO. (Park City)—Company's process of a chloridizing roast and leaching of old Ontario stope fillings has been simplified and improved.

SILVER KING CONSOLIDATED (Park City)—Shipments of up to 50 tons per day are being made, when roads permit. Winze sunk 30 ft. below 1550 is still in ore. Electrical equipment is to be installed to replace steam for running compressors and pumps.

SNAKE CREEK TUNNEL (Park City)—During February face was advanced 275 ft.; from 12 to 14 ft. per day is being made, with two shifts working. Flow is between 5000 and 6000 gal. per min., coming mostly from bottom of tunnel. When completed, tunnel will be 14,300 ft. in length, and of this half has been completed.

SILVER KING COALITION (Park City)—Installation of equipment in Alliance tunnel is well under way, compressor motors being in place, and work of installing hoist in progress. Silver Hill shaft, now down a few hundred feet, is to be sunk to contact of Ontario quartzite and limestone. It is proposed to sink 1000 ft. or possibly more. Connections between these workings and main shaft will make it possible to send out ore to latter on 500 level, from where all ore is shipped by aerial tramway.

DALY-JUDGE (Park City)—First quarterly dividend for 1914, amounting to 15c. per share, or \$45,000, has been declared, payable Apr. 1. Report for 1913 shows receipts for year to have been \$617,893, \$588,939 coming from ore sales, and \$28,453 from interest on surplus. Total expenditures, including dividends amounting to \$180,000, were \$649,521, leaving cash on hand, Jan. 1, 1914, of \$492,349. There were mined 53,897 tons of ore. Mill treated 48,943 tons of ore, from which were produced 11,909 tons of lead concentrates and 3719 tons of zinc middlings. Ratio of concentration was 3.1:1 for all concentrates and 4.1:1 for the lead concentrates. Crude ore averaged \$32 per ton, the concentrates \$30, and the zinc middlings \$19.50. Top slicing has been used in mining ore from the Daly vein, as ground here is often wet and heavy; drifts and raises are driven in foot wall. Work has been satisfactory, and no ore has been lost. Daly-Judge territory embraces a rectangular block of ground 4000 ft. wide by 11,000 ft. long, of which 3000 ft. on trend of vein has produced a total of \$7,220,554. A further contract for extension of Snake Creek tunnel has been given.

## VERMONT

TALC MINING AND GRINDING for paper trade, etc., is being done at several places in Green Mountains. Vermont ranks second in production of ground talc, being next to New York which has the bulk of western and foreign trade. Vermont's advantage lies in its proximity to paper mills of New England so that freight rates are better than from northern New York. Vermont's talc is not so fibrous as that in New York, but is more on order of foliated talc and is not so desirable for use as a filler in paper making. Milling processes have not yet reached elaborate stage which is case in New York, but much of the fine grinding is done by buhr-stones; this does not give so fine a product as tube-mill and cylinder methods. Following companies are operating in Vermont: American Mineral Co., Johnson; Magnesia Talc Co., Waterbury; Vermont Talc & Soapstone Co., Windham; American Soapstone Finish Co., Chester; Eastern Talc Co., East Granville; including Standard Talc Co. and Greely Talc Mines at Rochester. All are near railroad except Vermont Talc & Soapstone Co.

## CANADA

## British Columbia

BROKEN HILL (Lillooet)—Samples from recent workings on this property show high-grade gold ore. Orebody has a maximum width of 90 ft. Company owning property has announced its intention of building a large reduction plant.

PAYNE (Slocan)—Within next five weeks long tunnel will reach point where it should cut large orebodies that have been developed in upper levels. On Mar. 1 tunnel, which is being driven at rate of 200 ft. per month, was in about 3200 ft.

JEWEL (Eholt)—Twenty tons of round stones are being procured from Proctor, on Arrow Lake, for use in tube mill in silmilling ore. Mill is treating about 300 tons per week. During last two months Jewel shaft has been sunk from 300- to 400-ft. level.

JOSIE (Rossland)—Shipments, 1407 tons of ore in January and 100 tons concentrates. Receipts from smelter, \$28,666, being payment for 1820 tons of ore and 158 tons concentrates. Costs for corresponding period were, development \$12,000, ore production, \$7000, milling \$1250; total \$20,250.

VAN ROI (Silverton)—Mill crushed 2241 tons in January, yielding 123 tons lead concentrates assaying 178.5 oz. silver, 58.3% lead, 13.2% zinc, and 210 tons zinc concentrates assaying 52.4 oz. silver, 2.7% lead and 40.6% zinc. Expenditures for month, development, \$3326; ore production, \$4574; milling, \$3886; total, \$11,786.

## ONTARIO

YORK ONTARIO (Cobalt)—Directors have recommended that 250,000 shares of treasury stock be issued at 6½c. per share, money to be used for development.

CANADIAN GOLD FIELDS (South Porcupine)—Regular quarterly dividend of 1¼% and an extra bonus of ¼ of 1%, payable Mar. 15, has been declared.

NIPISSING (Cobalt)—At last meeting of directors, dividend was cut from 30 to 20%. This move was foreshadowed by recent action of stock which practically discounted out.

BURNSIDE (Swastika)—An English company, called Burnside Gold Mines, Ltd., with a capital of £400,000, has been formed to operate this property. Shares are now being issued to English purchasers.

PORCUPINE GOLD (Schumacher)—Recent offer for this property made by West Australian Gold Fields, Ltd., has not been accepted. Cash payment was stated to be too small.

McINTYRE (Schumacher)—Optimistic reports are coming from this property where mill heads are now stated to be running from \$10 to \$12; a few months ago, they were running about \$6. Development of new veins is giving promising results.

TECK-HUGHES (Swastika)—Kirkland Lake Proprietary has an option to purchase 1,285,000 shares of this \$2,000,000 company; \$40,000 has already been paid on account. Great Northern Co. which promoted the Teck-Hughes, received \$17,500 of this amount. Total purchase price is \$135,500, of which Great Northern will receive \$87,500.

JUPITER (South Porcupine)—Funds for development and equipment of this property have been secured by an arrangement between company and McKinley-Darragh, under which a new company will be formed to take over assets of Jupiter, capitalized at \$2,000,000. Shareholders of old company will receive half share in new concern for each share turned over, and remaining \$1,000,000 in shares will be taken up by McKinley-Darragh at 12c. per share, that company advancing in meantime \$30,000 for development purposes.

CANADIAN MINING & EXPLORATION CO. (Toronto)—Annual meeting was held in Toronto, Mar. 19. Report of President Ambrose Monell stated that 109 properties, of which 34 were more or less developed mines, had been examined during year. Of these, eight would have been satisfactory had terms been suitable, and nine of the prospects were in same category. Hope was expressed that negotiations with regard to some of these properties might yet be successful. Field covered by examinations of company's engineers extended from Newfoundland to British Columbia, and from Alaska on north to Lower California and Sonora on south. It is understood that company has two properties on Pacific Coast under option. Income for year was \$133,793, of which about \$78,000 was spent.

## BRITISH GUIANA

EXPORTS OF GOLD IN JANUARY were 4173 oz. fine, an increase of 1553 oz. over last year. Exports of diamonds were 1009 carats, valued at \$9613 in all.

## INDIA-MYSORE

KOLAR GOLDFIELD PRODUCTION in February is reported at 47,842 oz., being 1926 oz. less than in January, but 1441 oz. more than in February, 1913. For the two months ended Feb. 28 the total gold produced was 94,913 oz. in 1913, and 97,610 in 1914; an increase of 2697 oz. this year.

# The Market Report

## METAL MARKETS

NEW YORK—Mar. 25

The metal markets show rather more activity, with prices fluctuating within small limits and rather inclined to weakness. Export business is large, and there was an improvement at the close.

### Copper, Tin, Lead and Zinc

**Copper**—The activity chronicled in our last report subsided shortly thereafter. This was due mainly to the hesitancy on the part of European buyers to continue purchases in the face of the political disturbances in Great Britain and the bad financial conditions in France. While the majority of the agencies here displayed unconcern as to the halt in demand, at least two important sellers exhibited some nervousness and immediately pressed copper for sale, accepting materially lower prices than had previously been quoted and disposing of some millions of pounds thereat. On Monday, Mar. 23, when it looked as though the political disturbances in Great Britain would be composed, the London market improved, which brought in its wake a considerable European demand, and a fair volume of business was done at advancing prices. American consumers also became interested on the following day, when some round quantities were sold at 14½¢ @ 14½¢, delivered, usual terms, both for domestic and for foreign account, the sales for export continuing to predominate. On Mar. 25 the price of 14½¢, delivered, usual terms, was firmly established and considerable sales were made thereat. The market closes firm, with the metal in a stronger position, producers' books for the next two months now being reported as pretty well filled.

The average of electrolytic quotations for the week is 14.18 cents.

The market for Lake copper exhibits no material change. The principal producer has not let any alteration of its position be known. Other producers do a small business from day to day, but it is scarcely more than of carload order, which relatively is retail business.

The London market on Thursday, Mar. 19, was £64 5s. for spot and £64 13s. 9d. for three months. On Friday, Mar. 20, it declined to £63 18s. 9d. for spot and £64 7s. 6d. for three months. On Monday it advanced to £64 12s. 6d. for spot and £65 2s. 6d. for three months, and advanced again on Tuesday to £65 7s. 6d. spot and £65 15s. three months, closing on Mar. 25 at £65 7s. 6d. for spot and £65 15s. for three months. Cables report that the speculative sentiment is decidedly more favorable to ventures in copper than for some time past.

Base price of copper sheets is now 19½¢ per lb. for hot rolled and 20½¢ for cold rolled. The usual extras are charged and higher prices for small quantities. Copper wire is 15 @ 15½¢, carload lots at mill.

Exports of copper from New York for the week were 8411 long tons. Our special correspondent reports exports from Baltimore for the week at 3873 tons.

**Tin**—In the face of an almost entire absence of demand from American consumers, the London market, which was dull during all of last week, became very firm on Monday of this week. This reversal of form is doubtless to be attributed to the change in sentiment and the more hopeful views which are taken generally. While consumption in this country, especially in the tinplate industry, is very good, those interests seem to be covered for the present and do not appear as buyers. The market closes firm at £175 for spot and £178 for three months, and about 38½¢ for April tin here.

Arrivals of Bolivian tin at Liverpool in February were 1446 tons concentrates and 31 tons bars; equivalent to 899 tons fine tin.

**Lead**—The market is quiet and somewhat easier. There has been some pressure to sell Missouri lead, which during the last few days has been freely offered at 3.85¢, St. Louis.

On the afternoon of Mar. 25, the A. S. & R. Co. lowered its price from 4 to 3.90¢, New York.

There have again been sales in the London market of American domestic lead. The market is somewhat easier and Spanish lead is quoted £19 7s. 6d.; English lead 12s. 6d. higher.

**Spelter**—Scarcely any business is reported and quotations are hardly more than nominal. A good many producers have been offering the metal at 5.10, without being able to find buyers. Big consumers have offered to buy at 5¢, but producers have not wanted to go so low as that. Many consumers apparently would be willing to contract for future deliveries at around the present level of prices for prompts, but the producers who are carrying large stocks naturally do not want to mortgage their future, considering that consumers who are thinking about their later needs ought to buy the metal and carry it themselves.

London is somewhat easier, good ordinaries being quoted £21 7s. 6d.; specials, 10s. higher.

Base price of zinc sheets is now \$7 per 100 lb f.o.b. Peru, Ill., less 8% discount, with the usual extras.

### DAILY PRICES OF METALS

#### NEW YORK

Mar.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
19	4.8655	58	@14½	14.05	38½	4.00	3.85	*5.20	*5.05
			@14½	@14.15			3.85	@5.25	@5.10
20	4.8650	58	@14½	14.05	37½	4.00	3.85	*5.20	*5.05
			@14½	@14.15			3.90	@5.25	@5.10
21	4.8645	58½	@14½	14.05	38	4.00	3.85	*5.20	*5.05
			@14½	@14.15			3.90	@5.25	@5.10
23	4.8650	58½	@14½	14.10	38½	@4.00	3.85	*5.25	*5.10
			@14½	@14.20		3.97½	3.82½	*5.20	*5.05
24	4.8640	58½	@14½	14.20	38½	@4.00	3.85	*5.25	*5.10
			@14½	@14.30		3.90	3.82½	*5.20	*5.05
25	4.8630	58	@14½	14.40	38½	@4.00	3.85	*5.25	*5.10
			@14½	@14.40					

\*Nominal.

The quotations herein given are our appraisal of the markets for copper, lead spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.15¢ apart. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10¢ below that of electrolytic; of casting copper 0.15 to 0.25¢ below. The quotations for lead represent wholesale transactions in the open market for good ordinary brands; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb., are: St. Louis-New York, 15½¢; St. Louis-Chicago, 6¢; St. Louis-Pittsburgh, 12½¢; New York-Bremen or Rotterdam, 15¢; New York-Havre, 16@17½¢; New York-London, 16¢; New York-Hamburg, 18¢; New York-Trieste, 22¢.

#### LONDON

Mar.	Silver	Copper				Tin		Lead		Zinc	
		£ per Ton	Cts. per Lb.	3 Mos.	Best Sel'd	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
19	26½	64½	13.96	64½	69½	173½	175½	19½	4.23	21½	4.67
20	26½	63½	13.89	64½	69	172½	174½	19½	4.26	21½	4.67
21	26½										
23	26½	64½	14.04	65½	69½	175½	177½	19½	4.29	21½	4.67
24	26½	65½	14.20	65½	69½	176½	178	19½	4.23	21½	4.64
25	26½	65½	14.20	65½	69½	176	178	19½	4.21	21½	4.64

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½¢; £15 = 3.26¢ = £25 = 5.44¢; £70 = 15.22¢. Variations, £1 = 0.21½¢.



**Other Metals**

**Aluminum**—Small sales and a dull market are still the order of the day and prices are again weaker. The current quotations are 18@18½c. per lb. for No. 1 ingots, New York.

The Tennessee Power Co. has just begun delivery of current from its development No. 2, on the Ocoee River, to the initial plant of the Aluminum Co. of America, at Maryville, Tenn., a distance of 63 miles, under a contract calling for about 20,000 hp. annually. The Aluminum Co. of America has already spent more than \$1,000,000 in the construction of one of the most modern plants in the country.

**Antimony**—Business is quiet and the market rather dull. Prices are inclined to soften. Cookson's is rather firm at 7.25@7.50c. per lb. and Hallett's just steady at 7@7.15c. Chinese, Hungarian and other outside brands are 5.90@6.15c., and rather unsettled.

**Quicksilver**—Business is fairly active with sales good. New York quotations are \$38 per flask of 75 lb. for large lots, and 54c. per lb. for jobbing orders. San Francisco, \$38 for domestic orders and special terms for export. London price has been reduced 10s. and is now £7 per flask, with the same figure asked by second hands.

**Imports and Exports of Metals in Germany**, other than iron and steel and the precious metals, are reported as follows for the year ended Dec. 31, in metric tons:

	Imports		Exports	
	1912	1913	1912	1913
Copper.....	229,263	256,763	92,412	110,738
Tin.....	15,714	14,428	9,550	10,149
Lead.....	93,758	81,123	54,378	57,766
Zinc.....	58,112	58,520	135,015	138,093
Nickel.....	2,142	3,416	2,555	2,409
Aluminum.....	18,227	15,508	6,261	8,369
Minor metals.....	1,622	1,959	19,076	21,592

The tonnage of exports includes alloys and manufactures of the various metals.

**Gold, Silver and Platinum**

**Gold**—No premium is reported paid on the open market in London this week and the price of gold remained at 77s. 9d. per oz. for bars, and 76s. 4d. per oz. for American coin. There is still a demand for gold for Paris.

Imports of gold into Great Britain, two months ended Feb. 28, were £9,234,070; exports, £6,868,262; excess of imports, £2,365,808, which compares with an excess of exports of £989,407 last year.

**Platinum**—The market continues steady and practically unchanged. Dealers ask \$43@44 per oz. for refined platinum and \$46@49 per oz. for hard metal.

**Silver**—The market continues steady. The latest reports are that the London Syndicate has disposed of the large block of silver taken over from the failed India Specie Bank, with the exception of only £250,000 worth, so that the outlook for bullion is favorable for a slight rise if the Mexican difficulties should not be solved in a few months.

Shipments of silver from London to the East, Jan. 1 to Mar. 12, as reported by Messrs. Pixley & Abeil:

	1913	1914	Changes
India.....	£1,897,900	£1,400,000	D. £497,900
China.....	95,000	40,000	D. 45,000
Total.....	£1,992,900	£1,440,000	D. £552,900

Imports of silver into Great Britain, two months ended Feb. 28, were £1,843,360; exports, £2,527,179; excess of exports, £683,819, which compares with an excess of imports of £757,839 last year.

**Gold and Silver Movement in the United States** for two months ended Feb. 28, as reported by the Bureau of Statistics, Department of Commerce:

	Gold		Silver	
	1913	1914	1913	1914
Exports.....	\$29,611,057	\$15,992,834	\$11,751,255	\$7,602,044
Imports.....	11,566,831	13,660,226	6,682,021	4,232,637
Excess, exports...	\$18,044,226	\$2,332,608	\$5,069,234	\$3,369,407

Exports of merchandise for the two months this year were valued at \$377,879,546; imports, \$304,679,934; excess of exports, \$73,199,612. Adding excess of gold and silver gives \$78,901,627 as the total export balance.

**Zinc and Lead Ore Markets**

**JOPLIN, MO.—Mar. 21**

Blende again sold as high as \$43.50, the assay base ranging from \$37 to \$40.50, and the metal base from \$37 to \$40 per ton of 60% zinc. Calamine is also unchanged on a base of \$21@23 per ton of 40% zinc, and the average price of all grades of zinc is \$38.08 per ton. Lead sold as high as \$53,

the base continuing at \$50 per ton of 80% metal contents, and the average of all grades is \$49.96 per ton.

Weather conditions were much less favorable than the preceding fortnight, several days of snow proving a setback to hand-operated mines. The heavy buying movement continued throughout the week; the shipment of zinc was the largest of the year and the lead shipment was exceeded by only two previous weeks this year.

**SHIPMENTS WEEK ENDED MAR 21**

	Blende	Calamine	Lead	Value
Total this week..	12,759,040	692,430	2,757,750	\$315,015
Total 12 weeks..	123,175,270	7,225,110	21,514,350	\$3,118,595
Blende value, the week,	\$246,625; 12 weeks, \$2,496,525.			
Calamine value, the week,	\$9480; 12 weeks, \$82,165.			
Lead value, the week,	\$58,910; 12 weeks, \$539,815.			

**PLATTEVILLE, WIS.—March 21**

The base price paid this week for 60% zinc ore was \$39.50@40. The base price for 80% lead ore was \$50 per ton. No premiums were reported.

**SHIPMENTS WEEK ENDED MAR. 21**

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week .....	3,294,740	114,000	905,800
Year .....	34,552,450	1,181,100	11,776,470
Shipped during week to separating plants, 3,517,800 lb. zinc ore.			

**Exports and Imports of Ores in Germany**, other than those of iron and manganese, are reported as follows, for the year ended Dec. 31, in metric tons.

	Imports		Exports	
	1912	1913	1912	1913
Gold and silver ores.....	2,198	1,932	9	1
Copper ore.....	23,192	27,594	21,514	25,221
Tin ore.....	16,557	18,736	.....	4,458
Lead ore.....	122,847	142,977	3,273	4,458
Zinc ore.....	293,090	313,269	51,242	44,731
Nickel ore.....	14,987	13,658	.....	.....
Miscellaneous ores.....	29,186	28,004	12,009	20,160
Pyrites.....	1,073,285	1,023,952	27,917	28,214
Chrome ore.....	23,201	23,251	778	681

Miscellaneous includes ores of tungsten, molybdenum and the other minor metals. Imports of slag and slag products were 1,248,693 tons in 1912, and 1,310,460 in 1913; exports were 154,019 tons in 1912, and 153,156 last year.

**IRON TRADE REVIEW**

**NEW YORK—March 25**

There have been no special changes during the week, except the closing of some structural contracts and some railroad bridge and car orders.

The pig-iron market has turned chiefly on small orders. Foundry iron has been bought almost on a day-to-day basis.

The iron and steel market has shown no improvement at any point, and the condition continues of shipments being well in excess of new bookings. In a few instances production appears to be decreasing slightly but on the whole the steel industry is still operating at 70 to 75% of capacity.

Steel prices are weakening in spots, but in the absence of important buying the real extent of the weakening is not disclosed. Plates at 1.15c. are increasingly common.

The steel trade continues to expect increased buying in April, as marking the real opening of spring, but expectations of sufficient buying to enable mills to operate at full capacity before autumn have practically disappeared.

The usual quotation on bars, plates and shapes is 1.20c., Pittsburgh, but the figure is shaded more often than formerly, particularly in the case of plates. The Carnegie Steel Co. continues to quote a minimum of 1.25c., but it is fairly well known that after Apr. 1 it will modify this price to meet the independent competition already established and some interesting developments may occur.

**United States Foreign Trade in Iron and Steel** in January is valued by the Bureau of Statistics of the Department of Commerce as follows:

	1913	1914	Changes
Exports.....	\$25,141,409	\$16,705,836	D. \$8,435,573
Imports.....	2,860,510	2,334,895	D. 525,615
Excess, exports.....	\$22,280,899	\$14,370,941	D. \$7,909,958

Exports in January were the lightest for many months.

The total quantity of exports for which tonnages are given was 249,489 long tons in 1913, and 118,768 in 1914; a decrease of 130,721 tons, or 52.4%. The imports reported in quantity were 18,357 tons in 1913, and 17,837 in 1914; decrease, 520 tons. Many important articles are not given by weight, but only in values.

**PITTSBURGH—Mar. 24**

Mills in the Pittsburgh and Valley district continue to operate at about 80% of capacity, on an average, or at the rate which has obtained since the middle of February. In several instances sheet mills have slightly decreased their activity, but the sheet mills are still running well, at an average of fully 80% of capacity. The pipe mills are averaging about 90%. The wire market has shown no improvement with the progress of the season, and it is evident that too much business was anticipated early in the year to make the spring movement a good one. A few of the plate mills are operating at not over 50% of capacity, while rail production is small.

**Pig Iron**—The market is stagnant. Consumers of steel making iron are taking shipments fairly well, but foundry grades are hardly moving according to the terms of contracts. Sales are very light of all grades. A significant indication of the position of the merchant furnaces is that they have made no effort to purchase Lake Superior ore for the coming season, although the regular shipping season opens next month. Pig iron remains quotable as follows: Bessemer, \$14.25; basic, \$13; No. 2 foundry and malleable, \$13.25; forge, \$12.75, at valley furnaces, 90c. higher delivered Pittsburgh.

**Ferromanganese**—While the nominal quotation for prompt and contract English or German ferromanganese is \$39, Baltimore, there appears to be no difficulty in buying at \$38. The market is quiet, with transactions confined to small lots.

**Steel**—For nearly two months the regular quotations on billets and sheet bars have been \$21 and \$22 respectively for first quarter, with \$1 advance for second quarter. Automatically therefore the market would advance \$1 a ton on Apr. 1, but in view of the changed views of consumers it is doubtful whether any steel could be sold at the advanced figures. Rods are \$26, Pittsburgh.

**IRON ORE**

Little or nothing has been done about Lake iron-ore prices so far. The market in the East is also quiet, and offers of imported ore have not been taken up.

**British Iron Ore Imports** for the two months ended Feb. 28 were 1,346,147 long tons in 1913, and 1,040,200 in 1914; a decrease of 305,947 tons this year. Imports of manganese ore were 115,821 tons in 1913, and 90,318 in 1914; decrease 25,503 tons.

**Imports of Iron Ore in France** for the year 1913 were 1,417,063 metric tons, a decrease of 37,127 tons from 1912. Exports were 9,745,863 tons, an increase of 1,422,151 tons. Imports of manganese ore were 258,929 tons, an increase of 33,450 tons; exports 1705, a decrease of 567, tons.

**COKE**

Coke production is still increasing in the Connellsville district. The "Courier" reports the total make for the past week at 353,405 tons, and the shipments at 377,045 tons. The production in the Greensburg and Upper Connellsville districts was 44,340 tons.

**Coal and Coke Tonnage of Pennsylvania R.R. lines east of Pittsburgh and Erie, two months ended Feb. 28, short tons:**

	1913	1914	Changes
Anthracite.....	2,002,295	1,620,047	D. 382,248
Bituminous.....	8,067,500	7,674,179	D. 393,321
Coke.....	2,508,874	1,672,898	D. 835,976
Total.....	12,578,669	10,967,124	D. 1,611,545

The total decrease this year was 12.8%. The greatest change, both in actual tonnage and proportionally, was in coke.

**CHEMICALS**

**NEW YORK—March 25**

The general markets are still inclined to be quiet, with buying on a moderate scale only.

**Arsenic**—Sales have not been heavy and the market is quiet. The price is practically fixed for the present at \$3 per 100 lb. for both spot and futures.

**Copper Sulphate**—Business is not specially active and prices are steady. Current quotations are \$4.80 per 100 lb. for carload lots, and \$5.05 for smaller parcels.

**Pyrites**—Imports at Baltimore for the week included two cargoes, 10,263 tons, pyrites from Huelva, Spain. The imports of pyrites into the United States from Spain

in 1913 were 626,863 long tons; from Portugal, 108,360 tons. This total of 735,223 tons represents a decline of 256,114 tons as compared with the imports of 1912, and is the first time in 10 years that pyrites importations from these two countries have not shown an increase. The total imports from all countries, as given by the Bureau of Commerce returns, were 964,478 tons in 1912, and 848,674 in 1913; decrease, 115,804 tons.

**Nitrate of Soda**—The market is firm and steady, both here and abroad. Quotations are unchanged at 2.25c. per lb. for both spot and future positions.

**PETROLEUM**

Exports of crude oil from Mexico in February were: From Tampico, 970,361; from Tuxpan, 489,743; total, 1,460,104 bbl. The total for the two months ended Feb. 28 was 3,240,661 bbl. in all.

Production of petroleum in Galicia for the year was 1,187,000 metric tons in 1912, and 1,090,000 in 1913; a decrease of 97,000 tons.

**COPPER SMELTER'S REPORTS**

This table is compiled from reports received from the respective companies except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield then is reckoned at 97%. In computing the total American supply duplications are excluded.

	October	November	December	January	February
Alaska shipments	1,951,883	3,391,300	3,104,155	2,701,258	1,803,579
Anaconda.....	18,400,000	25,250,000	25,100,000	24,400,000	21,300,000
Arizona, Ltd.....	3,550,000	2,800,000	2,920,000	3,474,000	3,062,000
Copper Queen.....	8,292,929	7,115,991	9,033,459	8,796,358	6,987,366
Calumet & Ariz.....	4,500,000	4,600,000	5,230,000	5,975,000	5,596,850
Chino.....	4,767,468	4,270,821	4,390,018		
Detroit.....	1,861,878	1,922,352	2,021,034	1,590,681	1,814,214
East Butte.....	1,040,997	1,002,190	1,324,560	1,256,000	1,193,960
Giroux.....	156,084	250,000	197,649	148,411	
Mason Valley.....	1,052,000	1,174,000	1,372,000	1,444,000	
Mammoth.....	1,700,000	1,700,000	1,400,000	1,625,000	1,400,000
Nevada Con.....	5,898,046	5,443,647	5,343,862	5,791,122	4,588,243
Ohio.....	698,691	772,120	722,940	700,728	
Old Dominion.....	2,037,000	2,450,000	2,613,039	2,797,000	3,066,000
Ray.....	4,725,419	4,753,964	5,075,202	5,705,000	5,432,000
Shannon.....	1,216,000	1,110,000	1,078,000		904,000
South Utah.....	232,269	225,072	242,362	275,569	
Tennessee.....	1,392,162	1,666,753	1,700,000	1,474,890	
United Verde*.....	3,000,000	3,000,000	3,000,000		
Utah Copper Co.....	9,929,478	10,787,426	10,306,646	10,329,564	
Lake Superior*.....	5,500,000	6,600,000	6,600,000	7,400,000	8,500,000
Non-rep. mines*.....	6,200,000	6,000,000	6,250,000	6,200,000	
Total prod.....	88,102,302	96,285,636	98,024,926		
Imp., bars, etc.....	21,935,023	21,796,866	23,578,938		
Total blister.....	110,037,325	118,082,502	121,603,864		
Imp. ore & matte.....	5,062,015	8,980,186	12,205,187		
Total Amer.....	115,099,340	127,062,688	133,809,053		
Miamif.....	2,862,050	3,230,000	3,210,000	3,258,950	3,316,482
Shattuck-Arizona.....	993,224	995,429	1,050,781	1,276,636	1,134,480
Brit. Col. Cos.:					
British Col. Cop.....	688,581	655,637			
Granby.....	1,718,258	1,944,145	1,605,382	1,793,840	
Mexican Cos.:					
Boleof.....	2,424,800	2,315,040	2,315,040	2,369,920	1,984,000
Cananea.....	3,682,000	3,800,000	3,646,000	3,460,000	2,688,000
Moctezuma.....	3,178,136	3,517,800	3,139,613	3,024,556	2,642,543
Other Foreign:					
Braden, Chile.....	2,006,000	1,592,000	2,122,000	2,430,000	2,362,000
Cape Cop., S. Af.....	712,320	649,600	683,200	519,680	459,200
Spassky, Russia.....	983,360	904,960	900,480	902,720	
Exports from:					
Chile.....	6,160,000	7,616,000	10,640,000	5,488,000	6,720,000
Australia.....	7,728,000	11,200,000	6,720,000	7,512,000	7,952,000
Arrivals—Europe†.....	18,040,960	9,107,840	13,787,200	8,999,360	18,354,560

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.  
‡ Does not include the arrivals from the United States, Australia or Chile.

**STATISTICS OF COPPER**

Month	United States			Visible Stocks.		
	U.S. Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
Year, 1912	1,581,920,287	819,665,948	746,396,452			
III '13	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV.....	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V.....	141,319,416	81,108,321	68,285,978	75,549,108	85,948,800	161,497,908
VI.....	121,860,853	68,362,571	68,067,901	67,474,225	77,235,200	144,709,425
VII.....	138,074,602	58,904,192	78,480,071	52,814,606	77,904,000	124,808,606
VIII.....	131,632,362	73,649,801	73,263,469	53,594,945	66,420,480	120,015,385
IX.....	131,401,229	66,836,897	73,085,275	38,314,037	63,716,800	102,030,837
X.....	139,070,481	68,173,720	68,123,473	29,793,094	53,625,600	83,418,692
XI.....	134,087,708	48,656,858	70,067,803	32,566,382	48,787,200	81,353,582
XII.....	138,990,421	21,938,570	73,542,413	47,929,429	46,592,000	94,521,429
Yr., '13	1,622,450,829	767,261,760	869,062,784			
I, 1914.	131,770,274	47,956,955	87,955,501	91,438,867	53,916,800	145,355,667
II.....	122,561,007	47,586,657	83,899,183	87,296,685	50,108,800	137,405,485
III.....				78,371,852	47,376,000	125,747,852

Note—Visible supplies in Europe do not include copper afloat.



Mining Companies—United States

Table listing mining companies in the United States with columns for Name of Company and Situation, Shares (Issued, Par), Dividends (Total, Latest, Amt.), and dates.

Mining Companies—United States—(Continued)

Continuation of the mining companies table, listing companies like Seven Mountain, Adams, and others.

Iron, Industrial and Holding Companies

Table listing iron, industrial, and holding companies with their respective financial details and dates.

Canadian, Mexican and Central American Companies

Table listing mining companies from Canada, Mexico, and Central America with financial data.

\*Previous to reorganization, \$5,258,881. †Previous to January, 1910, \$324,644.

Assessments

Table with columns: Company, Delinq., Sale, Amt. Lists various companies and their assessment details.

Monthly Average Prices of Metals

SILVER

Table showing monthly average prices for Silver in New York and London from 1912 to 1914.

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Table showing monthly average prices for Copper in New York and London from 1913 to 1914.

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Table showing monthly average prices for Tin in New York and London from 1913 to 1914.

New York in cents per pound; London in pound sterling per long ton.

LEAD

Table showing monthly average prices for Lead in New York, St. Louis, and London from 1913 to 1914.

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Table showing monthly average prices for Spelter in New York, St. Louis, and London from 1913 to 1914.

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURGH

Table showing monthly average prices for Pig Iron in Pittsburgh from 1913 to 1914.

STOCK QUOTATIONS

Table of stock quotations for Colorado Springs and Salt Lake from March 24.

TORONTO

Table of stock quotations for Toronto from March 24.

SAN FRANCISCO

Mar. 17

Table of stock quotations for San Francisco from March 17.

N. Y. EXCH.

Mar. 24

Table of stock quotations for New York Exchange from March 24.

N. Y. CURB

Mar. 24

Table of stock quotations for New York Curb from March 24.

BOSTON CURB

Mar. 24

Table of stock quotations for Boston Curb from March 24.

LONDON

Mar. 13

Table of stock quotations for London from March 13.