

The Engineering and Mining Journal

VOLUME 97

FEBRUARY 28, 1914

NUMBER 9

Cyanide Plant of the Cornucopia Mine

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SYNOPSIS—The successful operation of a mine in Baker County, Oregon, is worthy of notice. The former treatment, amalgamation and concentration, recovered only about 65% of the value. It is now treated by the continuous, all-sliding cyanide process, recovering about 89%. The mine is modern and efficient.

The property of the Cornucopia Mines Co. is situated in the northern part of Baker County, Oregon, one mile from the town of Cornucopia. The mine is an old one, having been worked intermittently for the past 20 years with varying success. Until the present ownership and management, it had not been developed carefully and systematically, but there is now a large ore reserve.

The ore is hard quartz, containing from 3 to 5% pyrite carrying the gold. Silver is present partly as sulphide, and the proportions of gold to

silver by weight are approximately 1 : 5. There are also present in the ore appreciable quantities of chalcopyrite, arsenopyrite, and blende. The ores are variable in value, ranging from \$10 to \$20 for mill-run grade.

This ore was originally treated by the customary method of crushing with light stamps, amalgamating, and concentrating, with a canvas plant for the tailings. The mill was built in 1896 and succeeded in extracting only about 65% of the values. Owing to the fact that the mine is situated 25 miles from a railroad, the hauling, together with smelting charges on the concentrates, combined with the low extraction, made it very difficult to keep the property on a paying basis. It was therefore decided that, if possible, the ore should be treated by

cyanidation, thus eliminating outside charges on concentrates and at the same time making a better recovery of the metals contained in the ore. Tests showed that a satisfactory extraction could be obtained by grinding fine, and treating the product by agitation and filtration. Accordingly, in June, 1912, construction on the cyanide plant was started. The crusher, ore bins, and stamps of the old mill were left intact, and only such changes were made to the mill buildings as were necessary to

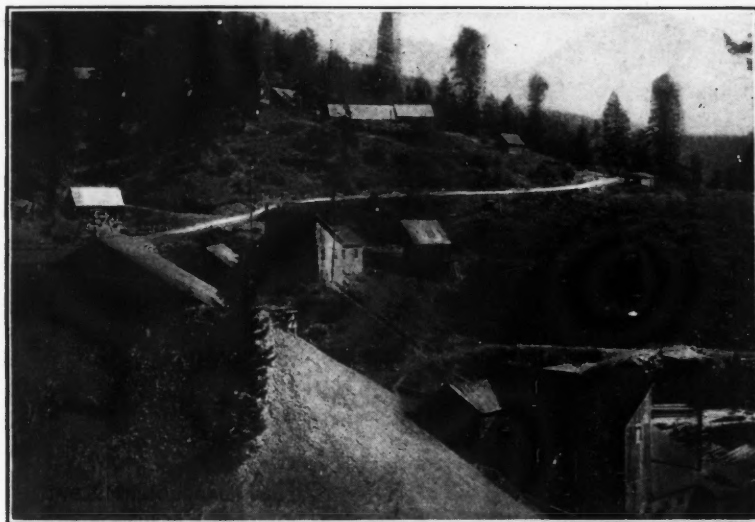
accommodate the new machinery.

METHODS OF CRUSHING AND GRINDING

The ore is received directly from the mine cars on three grizzlies set to 1½ in. The undersize falls directly into the ore bin, which has a capacity of 150 tons, and the oversize passes to a 9 x 15-in. Blake crusher, reducing the ore to 1½-in. size and delivering to the ore bin. The rock is then fed by challenge feeders to twenty 950-lb.

stamps which make 98 drops per minute through 7 in. Approximately 6 tons of a 0.125% solution of sodium cyanide per ton of ore are fed to the mortars, and the ore is crushed through No. 930 ton-cap screens, which correspond to about 8 mesh. Lime is added at the feeders in sufficient quantity to give the solution a protective alkalinity of 0.7 to 0.8 lb. CaO per ton. The stamp duty is 5.15 tons per stamp. Chrome-steel shoes and cast dies are used, which combination is giving excellent results. The shoes last from 80 to 90 days, while the dies usually last from 40 to 50 days.

At the beginning of operations amalgamation was given a thorough trial extending over a period of several weeks. With finer screens, the results obtained did not justify its continuation, due to the fact that there is but a small amount of free gold in the ore, and that the



PLANT OF THE CORNUCOPIA MINES CO.

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coarse crushing in cyanide solution made conditions unfavorable to good work. It was therefore discontinued.

The battery product is equally divided between two 4-ft. Callow cones, which remove the coarse sand and feed it direct to the tube mills. Fine grinding is accomplished in two 5x22-ft. tube mills mounted on tires. The advantage of this type of mill over the trunnion type is its lower power consumption. Each mill is driven by a 50-hp., back-gear, General Electric induction motor, which is connected to the tube-mill drive by a spring coupling. The mills make 26 r.p.m. and are lined with 4-in. silex blocks. This lining lasts seven months. Local quartzite is used for pebbles.

Each tube mill works in closed circuit with a simplex Dorr classifier, the overflow from the Callow cones being joined with the tube-mill discharge and fed to the classifiers. The sand discharge, joined with the underflow of the Callow cones, runs by gravity to the tube mills, which are equipped with scoops 6 ft. in diameter. The only product leaving the crushing and grinding department is the slime overflow of the classifiers.

Each tube mill is fed with 50 tons per day of material which has the following screen analysis:

Per Cent.		Per Cent.	
-10 mesh.....	95.9	-60 mesh.....	36.5
-20 mesh.....	74.2	-100 mesh.....	26.7
-30 mesh.....	60.8	-150 mesh.....	22.9
-40 mesh.....	50.4	-200 mesh.....	20.9

This material is first fed to the classifier, which removes the product finer than 200-mesh, returning the remainder to the tube mill for regrinding. The finished product has the following average analysis:

-100 mesh, 98% -150 mesh, 94% -200 mesh, 86%

As mentioned above, the ore is hard quartz and difficult to grind, and, even when ground so that 86% passes 200 mesh, it is still fine sand, and contains practically no colloidal matter or true slime.

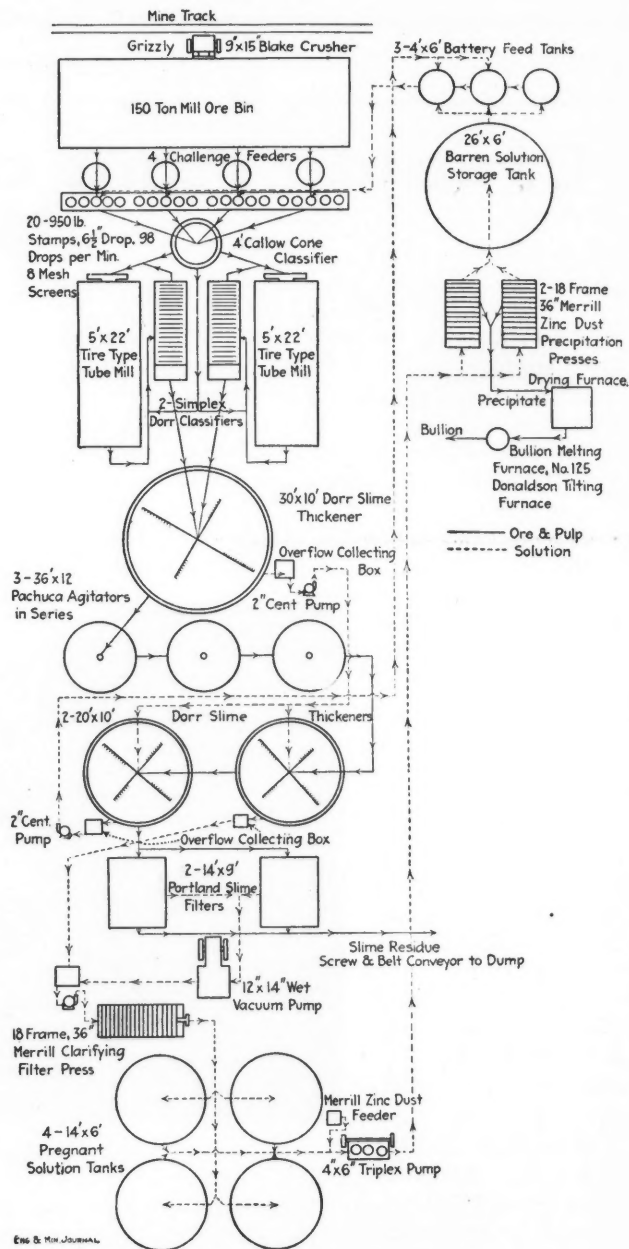
CONTINUOUS CYANIDE TREATMENT

The entire product from the crushing and grinding department flows by gravity to a 30x10-ft. Dorr thickener where it is thickened from a ratio of 6 : 1 to 2 : 1 for agitation. The solution overflowing this thickener is used for dilution, as will be described later. The thickened underflow is transferred by a 3-in. air-lift to the agitation tanks.

The three agitators are of the standard Pachuca type, 12 ft. in diameter and 36 ft. deep. They are operated in series, the pulp receiving about 36 hr. agitation in passing through the three tanks. The solution is brought up to the standard strength of 3 lb. per ton as it enters the agitation series. Continuous agitation has proven to be efficient and economical in operation, and the Pachuca tank gives satisfaction. Notwithstanding the sandy nature of the pulp and its quick settling properties, the agitators keep the pulp of a uniform grade throughout the series and after a year's continuous operation have disclosed no objectionable features. Compressed air at 30 lb. pressure is used, and when necessary, as after a shutdown, high-pressure air from the mine compressors can be furnished for starting.

Tests and experiments on the mill solutions have shown that approximately 35% of the total dissolution of the gold and silver takes place in the mill, while the remaining 65% is dissolved in the agitators. The solution carrying the pulp from the last agitator of the series is con-

sequently relatively high in value. The solution overflowing the 30-ft. thickener is also the lowest grade of the mill solutions. Owing to the fact that the filter plant consists of continuous, revolving drum filters, which are not adapted to the filtration of pulp which is carried in a high-grade solution, it is necessary to reduce, by dilution, the value of the solution which leaves the last agitator with the pulp.



Flowsheet of Cornucopia Mill

This dilution is accomplished in two 20x10 ft. Dorr thickeners, and the diluting solution is the solution overflowing the 30-ft. thickener. The two 20-ft. thickeners are run in series, and the solution overflowing the 30-ft. thickener runs into a collecting box from which it is pumped by a 2-in. centrifugal pump and equally divided between the two thickeners. The pulp leaving the last agitator overflows into a 3-in. air lift which transfers it to the first of the two thickeners. On entering, it is mixed with the diluting solution which brings the dilution up to approximately 4 : 1. It is

thickened in this tank to 1½ : 1, and the thickened underflow is transferred by a 3-in. air lift to the second thickener. The solution overflowing the first thickener is collected in a box, and flows by gravity to the precipitation plant. The pulp entering the second thickener is mixed with diluting solution and thickened to 1 to 1 for filtration, while the solution overflowing is returned to the battery for use in crushing. This dilution reduces the value of the solution leaving the second thickener to one-third of its original value, which is low enough for filtration. The pulp from the second thickener is carried by a 3-in. air lift to the filter plant.

The filter plant is composed of two continuous, revolving-drum filters. The drums are 14 ft. in diameter and 9 ft. face. In common with most vacuum filters, their capacity varies with the character of the pulp filtered, and on this sandy material the capacity is great. The entire product of 20 stamps can be handled easily on one machine, and as much as 115 tons have been filtered in 24 hr. The cake is ½ in. thick, and is washed by a series of sprays which are intended to keep the cake moist on its way to the scraper. The level of the pulp in the tank is kept as low as possible, and the cake receives a thorough air-drying before emerging from the tank. By the combined air drying and spray washing, the dissolved loss is kept to a reasonable figure.

A 12x14-in. Buffalo wet vacuum pump furnishes the vacuum for the filters, and discharges the filtered solution into a small collecting tank. The tailings from the filter are removed by the scraper and deposited on a belt conveyor which stacks it on the dump. The great advantage of these filters is in their low maintenance and repair cost, and in the fact that they do not require the services of a special filterman.

CLARIFYING AND PRECIPITATION

The solution to be precipitated comes from two sources; the solution overflowing the first of the 20 ft. thickeners, and the filtered solution. These solutions flow into a small collecting tank, from which they are pumped by a 3-in. centrifugal pump through a 36-in., 18-frame Merrill clarifying filter. The effluent from the press flows by gravity to four pregnant-solution sumps, each 14 ft. in diameter and 6 ft. in height. The Merrill system of zinc-dust precipitation is used. The zinc dust is fed by a screw feeder into an emulsifier, and the resulting emulsion of zinc dust is fed to the suction line of a 4½x6-in. Buffalo triplex pump. There are in use two 36-in., 18-frame Merrill zinc-dust presses. The triplex pump works against a head of approximately 85 ft. when filling the presses. The barren or precipitated solution leaving the presses flows by gravity to the main storage tank, 26 ft. in diameter, and 6 ft. in depth, which is situated in a separate building, and which supplies the small battery feed tanks.

Precipitation results have been satisfactory in spite of the fact that there is considerable copper dissolved from the ore, the precipitate often running 35% copper. The clean-up is made from 3 to 4 times a month. The precipitate is dried in a muffle furnace and melted direct in a No. 125 Donaldson tilting furnace using fuel oil. The resulting bullion varies considerably in grade depending on the amount of copper in the precipitate, but it usually averages 750 fine in gold and silver.

The extraction obtained is 90% of the gold and from

70% to 80% of the silver, making a total of 87.5% to 89 % of the value contained in the ore. Each ton of ore treated consumes 1.40 lb. cyanide, 3 lb. of lime, 0.90 lb. of zinc dust. These vary considerably with the different grades of ore, and the figures given above are an average of the consumption over a period of several months' operation during which period the value of the ore varied from \$10 to \$16 per ton.

In designing the plant, it was endeavored to make as many of the operations as possible, continuous. The object has been attained in that, since the beginning of operations, the plant has been run by two men on a shift exclusive of the crusherman. Crushing is done on two shifts only. The batteryman has charge of the stamps and the tube mills. He attends to all the work incident to the operation of this portion of the plant, and is assisted only in the larger battery repairs. The solution man operates the remainder of the plant. There is no steady attendant in the precipitation room. Melting is done by the assayer with his assistant. On the day shift, there is a repair man with one helper, who keeps up all the necessary repairs.

The plant requires 230 hp. when operating at full capacity. Power is furnished by the company's hydroelectric plant, situated about two miles from the mine. Current is transmitted at 6600 volts and transformed to 2200 volts at the mines for use in the motors. The cost of treatment averages \$2 per ton, and is subdivided as follows:

	Per Ton
Labor	\$0.65
Supplies	1.03
Power	0.12
Marketing product	0.20
Total	\$2.00

Owing to the distance from the railroad, a 25-mile haul, most of which is a rather heavy grade, the freight charges on all supplies are high. The property has been under the management of Robert M. Betts, since the present owners acquired possession, and the mill was designed by Walter L. Reid, of Telluride, Colorado.

The Gold Mines back of Juneau

The most dramatically interesting developments in the mining and metallurgy of precious metals are taking place back of Juneau, Alaska. A zone, about 20,000 ft. long by 1000 ft. wide in its widest point is being developed by three companies: the Alaska Gastineau, which owns about 12,000 ft. along the strip, the Alaska Juneau, which owns about 5000 ft., and the Alaska Ebner, which owns 3000 ft. This zone consists of a belt of slate in which quartz lenses and stringers occur with more or less irregularity. The gold contents in the pure quartz, that is, in the center of the lenses, are practically negligible, and the gold in the slate itself is also small in amount. The gold seems to occur chiefly at the contact between the quartz and the slate. Assays as high as \$90 per ton for a width of 8 in. have been obtained, but a recovery of \$1.50 is estimated for the whole mass that will be mined.

Naturally, the method of mining such a deposit, and the costs that will be incurred in mining, have received a great amount of attention. In the case of the Gastineau

Note—Excerpts from a speech by Sidney J. Jennings before the Mining and Metallurgical Society of America. M. M. S. A. Bull. No. 68.

a system has been worked out which promises favorable results. The foot wall of the deposit, so far as developed in this property, is fairly well defined by the fact that quartz lenses and stringers occur with greater persistence and regularity on the foot wall than anywhere else. This wall dips approximately 55° , and it is estimated that the silicification of the slate extends out for an average of 35 ft. from the foot wall, although many of the crosscuts show a much greater width than this. A drive is carried parallel to the foot wall in the country rock. At a height of about 30 ft. above this drift a parallel drift is likewise carried in the foot wall. This upper drift is called a "chute-tender's drift." Crosscuts from it at intervals of from 30 to 50 ft. are driven into the vein. From these crosscuts, stopes are opened out 7 or 8 ft. high and for the full width of the vein, say 35 ft., and the ore broken in these stopes is mucked into chutes which lead from the crosscuts to the working level. Stopes are then raised on the foot wall of the vein for from 20 to 25 ft. high, and at the end of a stope, say 200 ft. long, the vein is stoped clear across from the foot wall for as great a distance as commercial recoveries are found. There is thus prepared a block of ground about 200 ft. long by 20 to 25 ft. high, which is undercut on the bottom, on the foot wall side, and at two ends, and experience has proved that this block of ground will cave. The roof that remains after it has dropped, gradually slabs off until it assumes a position approximately at right angles to the foot wall, when it is quite safe again for the men to enter on the top of the broken ground and start their foot-wall stope once more. Thus actually only one-fifth of the ore sent to mill has to be mined, the remaining four-fifths breaking itself.

Such statement seems like a fairy tale. It did to me when it was first made; but after having examined the stopes where some 400,000 tons has been broken by this method, I am inclined to believe, under the conditions existing, and with the amount of silicification of the slate so far exposed by development, that the scheme will work.

Grizzlies are laid on top of the chutes before mentioned, and should these grizzlies become blocked by large lumps, the chute-tender going along the drift can in perfect safety bulldoze such lumps and keep the chute filled. These chutes are designed to hold 125 tons—approximately one trainload.

The train will consist of flat cars and will be trammed either by endless wire rope, or by electric locomotive to the main chutes, where the ore will be plowed off the cars by a stationary plow and dropped to the Sheep Creek tunnel level. At the start, this drop will be some 1400 ft., since the working of the mine will naturally commence at the part of the vein near the outcrop. The ore on the Sheep Creek tunnel level will be hauled in trains by electric locomotives to the mill, located on Gastineau Channel. In the mill the ore will be broken in crushers and rolls, and a large proportion roughed off, leaving only a small percentage to be finely ground, amalgamated and concentrated.

To most men familiar with gold mining, the crushing of gold ore with rolls is contrary to the vast bulk of experience. Rolls have been tried in the treatment of gold ore at many times, in many places, by many men, and so far with not sufficient success to warrant their installation on a large scale; but D. C. Jackling, who is responsible for the methods used in the Gastineau, is so confident, from the result of numerous experiments made with rolls, that they will be the best means of crushing for the particular

class of ore found in the Gastineau, that \$4,000,000 has been raised from the public to carry out his ideas on a large scale.

The Alaska Juneau has the maximum width of 1000 ft. on the slate belt. This company has driven a tunnel at an elevation of 350 ft. above sea level, and has crosscut the belt in the tunnel, where it appears to be 700 ft. wide; but owing to the fact that the tunnel cuts the belt at an angle, the actual width is about 500 ft. Owing to this great width, the Juneau cannot utilize the method adopted by the Gastineau, and will have to try some modification of a room-and-pillar method of stoping, combined with a caving process.

At the start the ore will be supplied from a quarry at the surface. The broken ore will be scraped by Oregon scrapers into a rock house, where it will be coarsely crushed and sorted by hand. The sorted material will be dropped through a chute to the tunnel level and trammed to the mill, which will be likewise located on the Gastineau Channel. F. W. Bradley, who has had great experience in treating gold ores on Douglas Island, has decided to use stamps in the mill. Mr. Bradley expects to have a mill of a crushing capacity of 600 tons per day ready during the coming year. In front of the stamps he expects to install machines which will carry out his flow sheet, as determined by the small experimental plant; but he realizes that this flow sheet will in all probability have to be modified when working on a large scale. The main idea of the flow sheet is to crush the ore to such a fineness that a large proportion of it can be roughed off, leaving only a small percentage to be finely crushed, amalgamated and concentrated. The money for the work on the Alaska Juneau is being put up by Mr. Bradley and a few of his immediate acquaintances, for while he is reasonably sure from his long experience on Douglas Island that a large percentage of the gross return from this slate belt can be realized as profit, he is not sufficiently sure to ask the public to come in and subscribe the large amount of money that will be needed absolutely to demonstrate this fact.

It is the race between the two ideas in the metallurgy of gold ores, as represented in the Gastineau and the Juneau, which forms the dramatically interesting feature of the situation. The Ebner is driving a tunnel to develop its section of this slate belt, and it will be able to profit by the large amount of work done by the other two companies in determining which method of milling will yield the more economical result. The mills of all these companies will be on Gastineau Channel, and, while no serious menace to navigation has been produced so far by the milling on Douglas Island, when amounts of 6000 to 20,000 tons per day shall be discharged into the channel, some other means than the mere wash of the tide will have to be utilized to get rid of the tailings. Probably tailing flumes two or three miles long will have to be provided to carry the tailings along the shore into deep water.

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New Qualitative Reaction for Bromine

Traces of bromine give a violet coloration to paper impregnated with a solution of fuchsine decolorized with sulphuric acid (*Rev. de Chim. Ind.*, January, 1914). Chlorine gives a brownish-yellow tint, iodine gives no color. The bromine reaction takes place in the presence of chlorine and iodine.

Lode Mining at Fairbanks

BY HUBERT I. ELLIS*

SYNOPSIS—Showing of the Fairbanks vein mines in 1913 a disappointment. No capital for preliminary development. Distillate engines and hydro-electric plant may furnish power. Sufficient water for milling. Shafts have a habit of automatic growth. Present situation at the various individual mines. Future prospects.

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During the last four years lode mining in the Fairbanks district of Alaska has advanced in a consistent, if not spectacular, fashion. Owing to the policy of reticence adopted by many of the operators, accurate figures of production are unobtainable; but from data furnished by the banks that purchase practically all of the bullion produced and from figures published by the U. S. Geological Survey the following estimates have been made:

Production previous to 1911.....	\$60,000
Production in 1911.....	64,000
Production in 1912.....	190,000
Production in 1913.....	285,000

Total production to Jan. 1, 1914..... \$599,000

Four mines have furnished the bulk of the output: The Rhoads-Hall, the Newsboy, the mine of the Reliance Mining Co., and that of the Chatham Mining Co. The Rhoads-Hall heads the list with an estimated production of nearly \$300,000.

Although production increased in 1913, the lode mining industry as a whole did not make so satisfactory a showing as had been hoped. The most discouraging features of present conditions and future outlook are the lack of capital for development work and the high cost of mining. No outside capital has yet found its way into Fairbanks quartz mining, due chiefly to the comparative isolation of the district, the small size and great irregularity of the orebodies, and geological conditions regarded as unfavorable by the mining engineers who have visited the district. These difficulties have not been sufficient to deter local capital, but with the depletion of the richest placer deposits, there is less and less local capital available. Under present conditions the mines must pay their own way from the beginning, and they are therefore forced to lead a precarious hand-to-mouth existence that cannot fail to induce a high mortality rate. An extensive campaign of prospecting and development work previous to actual mining, such as is necessary to any well regulated mining industry, is obviously impossible. Evidence is not lacking that there are bodies of low-grade ore larger than those now being worked, but these must necessarily be idle for a time.

ALASKA'S VIEWS OF THE RAILWAY BILL

In regard to the cost of mining, the outlook is no better. Until better transportation is provided—until, in short, a railway is built from Fairbanks to tidewater—costs must inevitably remain excessive. And, in view of the limited amount of business to be expected from the Fairbanks end of such a railway, it must be run solely in the interest of the public and not for revenue, if it is to benefit those it serves. At this writing there is a bill before Congress providing for the building and

operating of government railways in Alaska, and if it becomes a law the transportation problem will be happily solved. Great opposition to the bill is expected to develop on one pretext or another, however, and its immediate passage is doubtful. It is feared that many Congressmen, while publicly indorsing the project of government railways for Alaska, will delay action and in the end defeat the bill, because, ostensibly, they object to some minor detail of no real importance. In Alaska, the people are practically as a unit in favor of government railways for the Territory.

In the rest of the United States, the people wish to see Alaska developed as rapidly as possible; but through misconceptions engendered by lack of information in regard to the resources and conditions of the territory, and by the storm of criticism, the charges and countercharges, following the cancellation of the Cunningham coal entries, their ideas as to what should be done are as hazy as their notions of Alaska's climate and geography. Meanwhile there are believed to be powerful interests at work in opposition to the expansion of government participation in industry, whether in Alaska or elsewhere. It is believed, too, that there is effective, though unobtrusive, opposition being exerted by those interested in the California petroleum fields, the Eastern coal fields and the companies that transport the oil and coal to Pacific coast markets. So it is believed here that action on the Alaska railway bill will be postponed until public opinion throughout the country has had time to crystallize. This may be a mistaken view of the situation, distorted by too intimate a knowledge of conditions in Alaska and too superficial a knowledge of conditions in the States, but is believed to be justified by the circumstances.

POWER—DISTILLATE ENGINES

Second in importance only to the transportation problem, and intimately connected with it, is the power problem. Wood is becoming so scarce that it will soon be a luxury; 4-ft. cordwood can be bought in the woods for \$3.50 to \$4 per cord; delivered at the mines the cost is \$12 to \$15. At several properties distillate engines are being seriously considered as a source of power. But the uncertainty as to the future of most of the mines, consequent on the lack of ore reserves, will delay their installation. A makeshift steam plant can be purchased cheaply from the placer mines, and can usually be obtained on credit, whereas, internal-combustion engines require a cash outlay impossible for most of the mines. It has been estimated that distillate at 23c. per gal., plus transportation charges to the mines from Fairbanks, will cut down the power bill fully 50%.

HYDRO-ELECTRIC PLANT PROPOSED

It has been proposed that a plant for the generation of electricity be built on the Totatlanika River, about 60 miles from Fairbanks in an air line, and 80 miles from the mines. Numerous claims have been staked and some technical investigations have been made, but the project is still in the promotion stages. The dynamos, as provided in the tentative plans for the plant, would be driven

*Fairbanks, Alaska.

by water power during the summer and during most of the winter. An auxiliary steam plant would be built, to burn coal from the abundant supply in the nearby Nenana fields. A transmission line would carry the current at high pressure to a distributing station at Fairbanks, or at some place nearer the mining center. This proposal is worthy of serious consideration, since the greatest demand for power would come in the summer, when placer mining is in full sway, and when operating costs would be lowest. Its commercial feasibility, however, is rendered doubtful by the decadence of the placer-mining industry and the slow development of the lode mines.

THE INFLUENCE OF CLIMATE

That winter offers no obstacle to lode mining in the interior of Alaska has been satisfactorily proved at Fairbanks. All machinery and other supplies, however, must be shipped into the district during the summer. Freight-ing to the mines from the supply points can be done much more cheaply in winter than in summer, and it is customary to transport enough wood to the mines over the snow to last the entire summer.

Doubt has often been expressed as to the sufficiency of the winter water supply for stamp milling, but the experience of the last two winters has demonstrated that no trouble is to be expected on this score, where reasonable precautions are taken in choosing mill sites. In fact, groundwater seems to be much more abundant than the semi-aridity of the climate would indicate. The mean annual precipitation at Fairbanks is given by L. M. Prindle (Bull. 525, U. S. Geol. Surv.) as 11.8 in. Of this, about 40% is represented by the winter accumulation of snow, which runs off in the spring while the surface of the ground is frozen, so that only a negligible proportion of it ever joins the underground reservoir. The precipitation, then, that is available for underground circulation is 7 in. yearly, less the immediate surface run-off in summer and a smaller amount lost through evaporation. Since there is an annual period of at least seven months during which the groundwater receives no important addition, the water level would be expected to fluctuate considerably, rising in summer and falling in winter. It is interesting to note, however, that observation gives no reason to believe that such is the case; for in many mines, and perhaps in all, the water remains at a constant level throughout the year. No data have been collected as to the amount of water pumped or discharged through adits at the various mines at different seasons, but there is little reason to believe that it is materially less in winter than in summer. In general, it may be inferred from the experience in the district to date, that there will be no difficulty in developing an adequate water supply for any stamp mills or other reduction plants that will be required in the near future. Indeed, with the present cost of power, the unexpected abundance of water is a serious handicap to mining at depth.

MILL CONSTRUCTION

The only mill construction in 1913 consisted of the removing of the Straub mill from Fairbanks to the Rainbow mine on Skoogy Gulch, and the rebuilding of the three-stamp mill of the Reliance Mining Co., destroyed by fire late in 1912. Fourteen mills have been erected in

the district to date, and one more is in storage in Fairbanks. These mills have a total capacity of at least 150 tons daily. The average production at present is less than 45 tons.

CURIOUS DUCTILITY AND COMPRESSIBILITY OF MINE WORKINGS

The individual mines and prospects are scattered over so great a territory, embracing 300 square miles or more, that hearsay evidence must be largely depended on by anyone desiring to keep in touch with developments—and hearsay evidence is not always dependable. Even data furnished by mine owners themselves are subject to strange corrections on closer investigation. A 100-ft. shaft will shrink overnight to 70 ft.; curiously enough, it always shrinks on measurement, expansion being an unknown quantity in this connection. A shaft that is idle shows a weird tendency to increase its own depth; starting at 90 ft. in the fall, it will frequently reach a depth of 120 ft. by spring. Tunnels and adits are subject to similar vagaries, but on a smaller scale, possibly because it is easier to remove the spoil by wheelbarrow or car than by hoisting with the back-breaking windlass. The following notes on the individual mines are given, however, in the belief that they approach accuracy as nearly as such notes usually do. In any event it is only the details that are of doubtful accuracy, and as they are not constant, varying from day to day as mining proceeds, any deviation from the exact truth may be ignored.

THE RHOADS-HALL MINE

At the Rhoads-Hall mine, the winze 600 ft. from the portal of the main adit has been deepened to 140 ft. At 100 ft. the vein was dislocated by a fault, of which the direction and amount of throw have not been determined with certainty. At the bottom of the winze, cross-cutting disclosed a vein similar to the one being worked above, of which it is thought to be the faulted portion. As there are several parallel veins and stringers that are apparently closely related genetically, however, this conclusion is uncertain. The grade of ore disclosed by the crosscut and by drifts that were run along the vein is said to be too low to admit of profitable mining under present working costs. An extraction level has been opened at 100 ft., and water has been allowed to fill the lower drifts and parts of the winze. It is easily held at any desired level by the electric pump that was installed in 1912. Above the main adit much of the ore has been removed in the course of stoping, but for the protection of the workings below, a large surface pillar has been left along the entire course of the vein. This is chiefly in frozen ground, and prevents surface water from seeping down the old workings to make trouble below. It has been found that the ground can be much more easily held by timbering when dry than when the seams and joints are lubricated by water.

It is interesting to note that there is little frost in the ground in this mine below 50 ft. from the surface, and that, from the irregular occurrence of bunches of frozen ground at greater depths, there can be little doubt that the ground is gradually thawing out. This is in line with the general conclusion of geologists that the frozen ground of the interior of Alaska represents the remnants of the frost of the glacial period. At no place has frozen ground been found more than 100 ft. deep in

bedrock, although in the valley, alluvium shafts have been sunk 300 ft. in frozen material.

THE NEWSBOY

The Newsboy mine, after many vicissitudes, has been placed on a paying basis. The working profits for the three months of September, October and November aggregate \$7000, despite the fact that heavy expenses incurred in laying in a large supply of wood were charged directly to operating costs. The orebody is the largest in the district on which much work has been done, ranging up to 17 ft. in width. The ore is comparatively low grade, milling from \$11 to \$15 per ton. The mine is developed by an inclined shaft 340 ft. deep, but no stopping and little development work has been done below the 215-ft. level. There is said to be enough ore developed to supply the five-stamp mill for nearly a year, and the reserve is constantly being increased. As soon as the reserve is large enough to warrant it, the mill will be increased to 10 stamps or more, and gas engines will be substituted for steam power.

THE CHATHAM AND THE CRITES & FELDMAN

Both mine and mill of the Chatham Mining Co. were closed down late in 1913, except for prospecting work at the mine. It is uncertain when operations will be resumed on a large scale. The production to date has been \$75,000.

The Crites & Feldman property, embracing a group of claims situated on the right limit of Moose Creek, a tributary of Fairbanks Creek, made a good record during 1913. Several shipments of ore milling from \$40 to \$130 per ton were made. The claims are traversed by several veins more or less parallel. From a point just above Moose Creek, an adit has been driven 400 or 500 ft. on the most promising vein. This will eventually be extended to the limit of the claims, some 3,000 or 4,000 ft., and will serve as the main extraction level. Meanwhile, two shafts have been started farther up the ridge, to connect with the adit in depth. These are to be equipped with gasoline hoists, but the failure of the machinery to arrive before the close of navigation has greatly delayed sinking. A mill has also been ordered, and will be built near the adit, so that the ore can be dumped directly on the grizzly from the cars. This is the most promising of the undeveloped properties of the district, and will undoubtedly develop into a valuable mine.

HOMESTAKE, REXALL AND TOLOVANA

The Homestake mine, at the extreme head of Wolf Creek, has been leased to George Nightingale. It is developed by adit. The ore taken out during 1913 averaged over \$100 per ton. This is one of the four properties of the camp that can boast a substantial profit for the year; it may be noted in passing that three of the four profitable mines are developed by adit, whereas the great majority of the prospects must depend on shafts.

The Rexall mine, near the head of Wolf Creek, was closed down early in 1913 by the filing of labor liens. Work was carried on in a desultory fashion by the owners during the latter part of the year, but nothing of consequence was accomplished. The mill has been used to crush several shipments of ore from the Homestake mine.

Little progress was made during 1913 at the Tolovana mine, though considerable work was done by lessees and on company account. The mine was idle during November and December, with no immediate prospect of a resumption of activity.

THE SOO, HUDSON, RAINBOW AND PIONEER

Work was carried on during 1913 on the Soo claim, one of the group of claims lying at the head of Dome Creek, owned by the Reliance Mining Co., but better known as the Spaulding property. The shaft was sunk to the 100-ft. level and 350 ft. of drifting done on that level, besides 400 ft. on the 50-ft. The mine has produced about \$80,000 from 1200 tons of ore, an average value of \$65 per ton. The occurrence of the ore is so irregular, however, that mining costs are excessive. There are two mills in connection with the property; one of three 250-lb. stamps, situated at the mine and run with water from the mine; and another, of two 1000-lb. stamps, on Dome Creek, 2000 ft. from the mine. It was originally planned to run the small mill when water was available, and to use the larger mill when the 50-ton orebin at the mine was filled. The smaller mill, however, has been found equal to the capacity of the mine.

The Hudson mine, on Ester Creek, has been a disappointment in that it has not fulfilled its early promise—or the promises of its sponsors, as the case may be—of becoming a steady producer. A mill of two 1350-lb. Nissen stamps was built on the creek near the mine, but only two or three runs have been made with it. The ore milled was not of such grade as to warrant operations on a large scale.

There was activity early in 1913 at the Rainbow mine on Skoogy Gulch. Several hundred tons of ore was shipped to the Chena mill, and a patent Straub mill was later installed at the mine. Its operations were not attended with success, however, and the filing of labor liens forced cessation of work.

At the Pioneer mine, on the divide between the Cleary and Fairbanks Creek drainage basins, the shaft was deepened to 150 ft., and drifts were turned off at the bottom and at the 60-ft. level. Messhouse, bunkhouse and orebins were constructed, but work was stopped in June by the filing of labor liens.

OUTLOOK FOR THE FUTURE

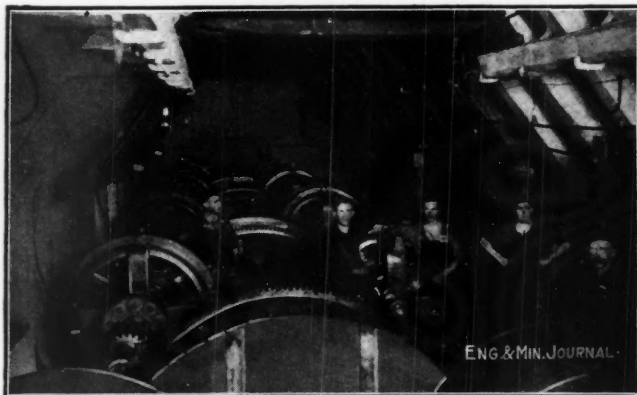
The experience of the last few years has demonstrated that, under present conditions in regard to transportation and the lack of capital, the lode mines of Fairbanks can be operated successfully in their development stages only on an extremely small scale. After sufficient ore is developed to justify it, mills may be built and work pushed more vigorously. There are now enough mills in the district to crush all the ore that will be produced in the near future, and these are so situated as to be accessible from all the important mining sections, with the exception of Fairbanks Creek. On this creek, Crites & Feldman will undoubtedly erect a mill during the current year. Although the Fairbanks lodes will unquestionably yield a large amount of gold in the course of time, the early hope that the production of the hard-rock mines would be sufficient to offset the dwindling output of the placer mines, and thus support the large population attracted to the camp in its halcyon placer days, is no longer justified—if it ever was.

New Pumping Plant at Aspen

BY CHARLES E. ANDERSON*

The ore zone of the Aspen district, in Colorado, was drained to a depth of 850 ft., for nearly 30 years, by duplex compound steam pumps. Eighteen years ago an attempt was made to drain the lower, undeveloped region to a depth of 1200 ft. by sinking the Free Silver shaft with an equipment of 16- and 14-in. duplex compound pumps. After one year's pumping, the whole scheme was abandoned, on account of the excessive drainage cost, so that the workings were flooded to the former level of 850 feet.

As the district was fortunate in having a well equipped electrical power plant for hoisting and all power purposes, the mine operators tried to solve the problem of application of electric power to pumping by introducing turbine pumps, and triplex plunger pumps with varying success. This attempt was eventually unsatisfactory. In 1907 variable-speed electric motors were perfected, so the General Electric Co. could guarantee continuous electric power to mining pumps under all conditions, and finally the Smuggler Mining Co. concluded to replace expen-



ALDRICH PUMPS IN FREE SILVER MINE

sive compound steam pumps with electric equipment suitable to gain against the often gushing flows.

As an initiation of the new system of pumping, one 7x12-in. Aldrich horizontal quintuplex pump with General Electric variable-speed motors was installed under a head of 550 ft. in the Argentum Juniata mine by the Smuggler company to drain one of the water channels, and to prove by comparison and actual work the most efficient and suitable pumps for future draining of the whole district. By measurement of the 2810-cu.ft. sump under the first pump thus installed, the efficiency of the pump at a varying number of from 45 to 60 strokes was 97%, and the motor efficiency 90%, or a combined efficiency of 87.3%. As the motor and pump were under perfect regulation under varying quantities of gritty flow, the quintuplex type after a service of two years proved that the continuous-flow type of pump was most durable for mining drainage.

The present equipment in the Free Silver shaft of the Smuggler Leasing Co. in addition to the above mentioned pump comprises five 7x12-in. Aldrich vertical quintuplex pumps, each connected with two 125-hp., 400-600-r.p.m., 550-volt, direct-current, shunt-wound, commutating-pole,

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General Electric motors. These five pumps have a combined capacity of 3500 gal. of water per min. under a head of 1150 ft. The pump station is built in two stories. The pumps are in the bottom, or basement, and the motors in the upper story of the station, shown in the accompanying photograph. The cost of pumping has been reduced to 50% of the former expense of steam pumps besides the relief from all annoyance connected with the attention of steam pumps.

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Gold Production of Australasia

Corrected December figures for the gold output of Australasia, substitute a small gain in 1913 over 1912 for the expected loss. The increase is only 0.6%, but it is at least a check in the continuous decline which has been reported for the past five years. The accompanying table gives the figures for the different states with the December figures fully reported, except for South Australia and the Northern Territory which are partly estimated. The Northern Territory is no longer attached to South Australia, but is administered by the Commonwealth. The returns from the scattered mines and placers are slow and uncertain, and there is a suspicion in Australia that not all of the gold operations are reported or even known.

GOLD PRODUCTION OF AUSTRALASIA

	1912	1913
Western Australia.....	1,282,658	1,314,143
Victoria.....	480,130	467,000
Queensland.....	347,946	263,315
New South Wales.....	165,295	183,773
South Australia.....	6,592	6,200
Northern Territory.....	5,000	5,350
Tasmania.....	37,973	36,150
Commonwealth.....	2,325,595	2,275,931
New Zealand.....	310,796	376,157
Total, oz.....	2,636,391½	2,652,088
Total value.....	\$54,494,202	\$54,818,659

The change above referred to was brought about by small increases in New South Wales and Western Australia, and by an unexpectedly large return from New Zealand in the closing month of the year, concerning the details of which no full accounts have been received. It is possible that Australia has turned the corner and that its gold production may once more begin to increase; but this is by no means certain.

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San Toy Mining Co.

The San Toy Mining Co., Pittsburgh, Penn., operating in Chihuahua, Mexico, states in its annual report for 1913 that net earnings amounted to \$132,427. Income was as follows: gross value of 7056 tons of ore sold, \$334,728; interest and exchange, \$29,053; total, \$363,781. Dividends amounting to \$115,000 were paid, leaving \$513,228 in undivided profits.

In spite of the revolution the mine was operated continuously except from June 26 to July 22; shipments of ore were discontinued, however, on Oct. 31, when the American Smelting & Refining Co. closed down its smelting plant. Owing to the war the efficiency of common labor has been much lowered and skilled labor has been driven from the country. Ore mined amounted to less than 100 tons more than ore shipped, ore returns from the smelter gave 78.5 oz. gross silver per ton. The average net value of silver was 57.45 per oz. There were 4007 ft. of development work performed at both shafts.

Tube-Milling Practice

By H. S. GIESER*

SYNOPSIS—A review of the history of tube mills in connection with precious-metal reduction, their advantages and drawbacks. Notes are given of the standardization of practice in different localities. Tube-milling costs are varied on different ores.

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Now that the tube mill occupies so important and well established a place in the milling of gold and silver ores, and its cousin, the Hardinge mill, is being so widely adopted for the fine grinding of copper ores, it is interesting to look backward and trace its development step by step to its present state of perfection. In 1870 Alsing introduced tube mills in England for the grinding of calcined flints in pottery work, and they were to some extent adopted for that purpose. In 1893 there was a wet-grinding tube mill at work near Wickes, Mont., which did good work. Sutherland, in 1898, was responsible for their introduction into West Australia, and the following year they were adopted by Doctor Diehl, who is chiefly responsible for their wide use today. In July, 1902, a description by Knutsen was published by the Institute of Mining and Metallurgy, describing them as used by Doctor Diehl. In the meantime, however, they had been widely adopted for grinding cement clinker and their first important use was for that purpose.

FIRST LARGE-SCALE USE WAS ON THE RAND

At Kalgoorlie the ore was soft but to improve extraction it had to be ultimately slimed. The mill used was 4x17 ft. and was charged with four tons of flint balls. It had long been known on the Rand that to increase extraction finer grinding was necessary, and at the July, 1903, meeting of the Chemical, Metallurgical and Mining Society of South Africa, H. S. Denny proposed the adoption of tube mills for this purpose. The following year he and others were operating them. At the end of 1904 there were 11 tube mills running to the 7199 stamps, giving a duty of 5.05 tons per stamp. Of these, two were at the Robinson Deep, and when results were published of their operation, showing a saving of 0.48 dwt. per ton, and an increased tonnage of 2300 tons, their merits were more closely examined. At the end of 1905 there were 58 tube mills at work on 24 mines. At this point they became recognized as of importance, and their development was rapid. By the introduction of tube mills the extraction by amalgamation was raised to 65 or 70%, of which 10 to 15% was on tube-mill plates.

In January, 1904, prior to their use on the Rand, tube mills were in operation at El Oro, Mexico, and here again their use was followed by increased profits. As the tube mill grinds finer than it is economical to crush by stamps, the extraction is increased and also there is a greater tonnage crushed, due to coarser screens being used on the batteries. A great deal of the early success of the tube mill was due to the pioneer experimenting of Burt and Caetani, at El Oro, and Dowling on the Rand, who published results of their tests.

In their very important paper on fine grinding and

cyaniding, Burt and Caetani¹, in 1906, concluded that the efficiency of tube mills increases proportionally to the amount of pebbles contained in mill; that efficiency increases with coarseness of sand fed to mill; that efficiency decreases proportionally to the rate of feed, and that it is important not to try to get a very fine product at the first operation by reducing the feed to below three tons per hour. It is far better to overcrowd the mills and return coarse sand.

Dowling², in 1906, published some notes on the operation of tube mills using tubes 5x22 ft., and among other things said, efficient classification was necessary. The thicker the pulp the better the grinding, and less wear on pebbles and liners. It is important to separate all unnecessary water, maintain full load of pebbles in the mill and its correct speed.

Fox, in 1908³, gave the results of an important series of experiments. He used a tube mill 5x23 ft., lined with 4-in. silox. Inside dimensions of the mill were 4 ft. 4 in. by 22 ft. 4 in. Total volume, 350 cu.ft., and maximum pebble load, 33,600 lb. The material ground was sand from chlorination barrels, passing 12-mesh screen.

He determined that with constant feed and constant pebble load it took 55 hp. to grind 50% through a 150-mesh screen, using 39.56% moisture, while with 54.6% moisture, 62.3 hp. was consumed to grind 51% through 150-mesh screen.

In varying the pebble load as pebbles were added, power increased up to 23,000 lb. pebbles, or 68.5% by volume of the mill, and 77.18 hp. was consumed. The best load was found to be 18,000 lb., or 53%, by volume, of the mill. With this, 67.5% of the material ground would pass 100-mesh screens, using 47.16 hp. The addition of further pebbles increased the power consumed without increasing the percentage of minus 100-mesh material produced. As rate of feed goes up (within certain limits) power goes down, but saving is more than counterbalanced by decreased amount of minus 100-mesh material. In thick pulp, which also shows less power consumed, there is a decrease of minus 100-mesh material, but the amount of ore ground to pass 100-mesh is nearly constant for all feeds. Fine grinding, power consumption and pebble and lining consumption depend on pebble load, tonnage, percent moisture and speed of rotation. The latter is, however, generally constant. A change in any one will vary two and sometimes three of the factors.

GRINDING DATA ESTABLISHED AT PACHUCA

Sherrod⁴, at Pachuca, published the results from a series of tests made to determine the most efficient feed for tube mills, and to compare tube mills of different sizes. One feature of the test was the fineness of the feed, 7% only remaining on 60-mesh. This was due to careful grinding and concentration necessary to recover the silver minerals. The conclusions were that grinding efficiency increases with the increase of percentage of solution up to

¹Trans., A. I. M. E., February, 1906.

²Journ. Chem., Met. and Min. Soc., South Africa, April, 1906.

³"Mines and Minerals," June, 1908.

⁴Mex. Inst. Min. and Met., December, 1909.

*La Fundacion, Peru.

40 or 45%. That grinding efficiency increases with increase of feed up to a point, depending on the diameter of the mill, beyond which capacity is not gained and, within limits, no loss occurs except excessive return. It was inconclusively proved that a 5x20-ft. tube mill has lower grinding efficiency than one of smaller size.

Ball⁵, experimenting with a 3-ft. 5-in. by 4-ft. 8-in. tube mill, lined with 2½-in. silix blocks, concludes that 37.7% is the best moisture to use on his ore. That with increased feed the efficiency increased up to 18 tons for 24 hours and with 23 tons gave about the same percentage of —120-mesh material. That crushing efficiency is highest when the volume of pebbles equals 60% of the volume of the mill. That 37 r.p.m. is the best speed, for if speed be increased or decreased, more power is used and crushing effect lessened.

VARIED SIZE OF TUBE MILLS USED

In reading descriptions of grinding plants in various parts of the world, one cannot help noticing the great difference in the size of the tube mills used. Different sizes are used in different districts and frequently even in the same mill. They often vary out of all proportion to the hardness of the ores.

In Kalgoorlie, in West Australia, the ore is an altered greenstone schist, carrying about 70% quartz with the percentage of quartz increasing in depth. It all has to be slimed. Some of the earlier tube mills used were 3¼x13 ft., containing 108 cu.ft. They ground 27 tons per day, taking 20 hp. at 37 r.p.m. The more common size is 4x16 ft., 201-cu.ft. volume. They crush about 33 tons per day through 200-mesh, consuming 30 hp. at 29 revolutions.

At the Waihi⁶ mine, in New Zealand, where the ore is notorious for its hardness, the eight tube mills are 4¾x18 ft., having 319 cu.ft. The power consumption is 55 hp. for 110 to 120 tons of output.

The ore on the Witwatersrand, in South Africa, is a conglomerate of quartz pebbles cemented by silica. It is probably not so hard as that at the Waihi. One of the early tube mills, at the Treasury mine, was 3½x13 ft., containing 125 cu.ft., and took 20 hp. to operate. At the Robinson Deep, in 1906, the tube mills were 5x22 ft., volume, 432 cu.ft. and at 29 r.p.m., 250 tons per day were milled at a cost of under 12c. per ton. The common or standard tube mill used on the Rand today is 5½x22 ft., containing 523 cu.ft. But two important mills have been built lately, in which the diameters of the tube mills have been increased to 6 ft. and the length shortened to 16 ft. Present Rand practice, according to Ball,⁵ is 130 tons of pulp passing 90-mesh for 75 to 90 hp.

VIRTUES OF TUBES OF DIFFERENT SIZE

In general there has been little published regarding the efficiencies of different-sized tube mills working under the same conditions. In speaking of Rand practice in 1906, in the "Journ. Chem., Met. and Min. Soc. of South Africa," J. E. Thomas said that small tube mills were installed at the Luipaards Vlei Estate, and the experience was that they were more economical in power consumed than large ones. In 1908, in the same "Journal," H. A. White ridiculed the idea of using 3¼x13-ft. tube mills, costing \$0.608 for grinding such infinitesimal outputs as 27 tons per day, requiring 20 hp. at 31 r.p.m., as in use in

⁵I. M. M., 1911.

⁶"Min. and Eng. Rev.," Mar. 6, 1911.

TUBE-MILL DATA

Company	When Published	Number of Mills	Make	Size	Volume Cu.Ft.	R.p.m.	Capacity Tons per 24 Hr.	H.P. Consumed	Pebbles	Lb. Pebbles per Ton	Cost Pebbles per Ton	Kind of Lining	Cost of Lining	Total Cost per Ton Milled	Remarks
Oroya Brownhill, W. Australia	1904	5	.....	Inside 3'8"x13'7" 4'x16'	143	29	37.5 thru 200 mesh	17	.....	.....	.....	Hard Iron	.....	\$0.421	Power cost \$0.099
Hannans Star, W. Australia	1904	..	.....	4'x16'	201	29	38, 95%-150 mesh	30	5.5 Tons Flint	.....	.....	.....	.....	0.436	Feed 70% + 100 mesh 24% — 150
Yuanmi, W. Australia	1912	1	.....	4'x16'	201	..	34, 150	30-35	Flint	.....	.....	Corrugated Mn Steel Cast Iron Ribbed	.....	.....	.....
Waihi, New Zealand	1911	3	.....	Inside 4'9"x18' 5'6"x22'	319	25-26	110, 120	55	5.5 Tons Flint	2.6	\$0.017	Cast Iron Ribbed	\$0.011	0.064	Feed 10 mesh 1½ tons per hp. (from ball thru 90 mesh)
Rand, South Africa	1912	..	.....	5'6"x22'	523	28	130 thru 90-mesh	75 to 90	8-14 Tons Quartz	.....	.....	Silix	.....	.....	Feed 3 mesh (0.29 in.) Lining lasts 300 days
Rand, South Africa	Private	8	.....	5'6"x22'	523	28	240, 90%-90 mesh	108	13 Tons Quartz	.....	.....	Ribbed El Oro	.....	0.156	.....
Dos Estrellas, El Oro, Mex.	1909	4	Allis-Chalmers Krupp	5x24	471	28	75, 58%-200	.....	Quartz	.....	.....	Ribbed	.....	.....	Feed largely quartz and tailings
Esperanza, El Oro, Mex.	1912	10	.....	Inside 48½"x19'8" 5'x16'	250	32	40	40	Quartz	.....	.....	.....	.....	.....	.....
Santa Gertrudis, Pachuca, Mex.	1912	6	.....	5'x20' 4'x20'	314	..	.....	.....	Quartz	.....	.....	.....	.....	.....	.....
Mexico, Mines of, El Oro, Mex.	1912	6	Krupp	5'x20' 4'x20'	392	31	50, 60	.....	Quartz	.....	.....	El Oro	.....	.....	.....
Lucky Tiger, Sonora, Mex.	1912	5	P. and M. M. Co.	5'x14'	274	..	90%-200	43 to 48	Flint	8.7	.....	Ribbed	.....	0.65	Feed 0.75 millimeter
Montana-Tonopah, Nev., U.S.A.	1908	2	Allis-Chalmers	5'x22'	432	27	52, 66%-200	42.5	.....	2.2	0.055	4" Silix	0.069	0.358	Lining lasted 8 mos.
Goldfield Con., Goldfield, Nev., U.S.A.	1912	6	A. C.	5'x22'	432	23	.....	60	.....	1.8	.....	Silix Ribbed	0.023	0.166	Silix lasts 7 mos. Silent chain drive
Bloss Oak, Tehachas Co., Calif.	1912	1	Abbe	5'x22'	353	23	.....	43	.....	.....	.....	4" Silix	.....	0.0769	Lining lasts 9-10 mos. Silent chain drive
Liberty Bell, Telluride, Colo.	1913	3	A. C.	5'x20'	432	28	90	.....	.....	.....	.....	.....	.....	.....	.....
Hollinger, Porcupine, Ont., Can.	1912	4	A. C.	5'x20'	392	28	90%-200	.....	.....	.....	.....	.....	.....	.....	.....
Dome, Porcupine, Ontario, New Nipissing, Low Grade, Cobalt, Ont.	1912	4	A. C.	5'x22'	432	32	.....	.....	.....	.....	.....	.....	.....	.....	.....
New Nipissing, Low Grade, Cobalt, Ont.	1913	4	.....	6½x22	730	..	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cement Industry	1912	..	.....	5x22	432	..	.....	70-80	.....	Flint	.....	.....	.....	.....	Product from ball mills

West Australia. As has been shown, tube mills 5 ft. in diameter had long been in use on the Rand and the increase to 5 ft. 6 in. was probably made at the time the thickness of the liners was increased from 4 to 6 or 7 in. The 6x16-ft. tube mills installed at the new Consolidated Langlaagte mill have been doing good work. Nine tubes taking the product from 90 stamps, 1900 lb. each, using screen openings of $\frac{1}{2}$ and $\frac{3}{8}$ in., and reducing 17 tons per stamp, so that about 3% is + 60-mesh, with a consumption of 67 horsepower.

Tests have been recently conducted on the Rand as to the most suitable length of the tube mill. It being thought that as little wear takes place on the last 4 to 6 ft. of the lining, the 22-ft. mill may be too long. C. O. Schmidt favors cutting them in two and feeding at the center. No results have as yet been published regarding these shortened mills.

In the El Oro¹ district in Mexico, where the ore is an exceedingly hard chalcedonic quartz that has to be all slimed, a different-sized tube mill is popular. At the El Oro plant three different-sizes of Krupp tube mills and two of another make that proved inefficient were installed, and elaborate experiments undertaken to find out which was the most efficient:

No. 3 Krupp tube mill 3 ft. 11 in. diameter by 19 ft. 8 in. long.

No. 4 Krupp tube mill 4 ft. 11 in. diameter by 23 ft. 9 in. long.

No. 5 Krupp tube mill 4 ft. 11 in. diameter by 26 ft. 3 in. long.

The smaller size, containing 237 cu.ft., proved the best for that particular ore, and has been installed in the three plants operating in El Oro proper. However, the two plants of the Dos Estrellas company, on the other side of the hill, are equipped with 5x24-ft. tube mills, of 471 cu.ft. volume. El Oro tube mills ground 125 tons of sand per day for 60 hp., so that 90% passes 100-mesh and 60% passes 200-mesh.

Sherrod⁴, at the Real del Monte, Pachuca, Mexico, tested four tube mills. No. 1 Krupp, 4x18 ft., 226 cu.ft. capacity; Nos. 2 and 3 Abbe, $4\frac{1}{2}$ x15 ft., 238 cu.ft. capacity; No. 4, D. E. Works, 5x20 ft., 392 cu.ft. The best amount of feed for the 4x18-ft. tube mill, which was the most efficient one, at 31 r.p.m., was 115 metric tons. For the $4\frac{1}{2}$ x15-ft. mills, the best feed was somewhat less. It was inconclusively proved that the 5x20-ft. tube mill has lower grinding efficiency than those of smaller diameter. It should be remembered that only 7% of the feed remained on 60-mesh. In northern Mexico, at the Veta Colorado, Parral, 5x14-ft. tube mills are in use, and the same size also at the Lucky Tiger, in Sonora.

MILLS IN UNITED STATES ALSO OF VARIED SIZE⁷

At Goldfield, Nev., the ore is classed as soft, but 40% of the product fed to the tube mills is extremely hard quartz and is reduced to — 200-mesh with difficulty. In the old Combination plant the tube mills were 4x12 ft. and 4x16 ft., and it is interesting to note that the large mill of the Goldfield Consolidated, its successor, has 5x22-ft. tubes. At the Homestake, in South Dakota, the first tube mill was 5x14 ft., and a later one, 5x18 ft. in size.

In the Tonopah district, Nevada, there are a number of tube mills in use, mostly in small plants. They vary

from 5x14 to 5x22 ft. One of the newer mills, the West End, has two tube mills 5x18 ft., according to Megraw⁸, and the change to larger diameter and less length has resulted in an increased production of slime at a power consumption per ton of ore equal to or less than that used with long tubes. An added advantage is that less floor space is required. So notwithstanding published results as to the small size being most efficient, the 5x18-ft. tube mill is probably the most popular in North America at the present day and the larger African standard, $5\frac{1}{2}$ x22 ft., is not met with. An important consideration in determining the size of the tube mill is the kind of a liner that is to be used. It is much cheaper to use a 6- or 7-in. siliceous lining than a 4-in. one, and a 6-in. liner when new decreases the available volume of a 5x22-ft. tube mill by 36%. A 4-in. liner decreases it by only 25%, so that in places where the siliceous liner is cheaper, or more popular than the rib type, it might be better to use a $5\frac{1}{2}$ x22-ft. tube mill, thus increasing the volume by 17 per cent.

MANY TYPES OF LINERS HAVE BEEN USED

Wooden blocks were early tried for tube-mill liners, but they only lasted a few days. Then smooth iron plates 1 in. thick were used for some time. Then siliceous blocks $2\frac{1}{2}$ in. thick were used, the thickness being later increased to 4 in., then turned on end, giving a thickness of 6 or 7 in. At the Treasury⁹ mine, on the Rand, in June, 1905, siliceous lining cost half as much and lasted $2\frac{1}{2}$ times as long as smooth iron liners. On the Rand they have a hard compact flint near-by that has given excellent results and has consequently been very popular. However, the ribbed type has been growing in favor. From tests made at the Simmer and Jack mine,¹⁰ a siliceous lining gave 133.5 tons of sand, 54.6% of which passed 90-mesh, and an Osborn liner, 139.5 tons, 57.2% of which was — 90-mesh. The ribbed liner was originally introduced at El Oro, but its use is now world-wide and its modifications endless. Each district seems to have something a little different.

One of the best modifications is used on the Rand and known as the Osborn liner. It consists of bars of flat iron laid lengthwise alternately flat and on edge. The latter are generally wedge-shaped and the bars come in lengths so that one, two or three pieces completes a course. They are held in position by iron wedges. Using a bar slightly less than the length of the mill has the advantage that it is less liable to become loose and fall. When these long bars become worn at the feed end they are taken out and the ends reversed. Using three pieces to a course has the advantage that as the head section becomes worn a new one is put in. Later, the section is changed and later still, the third. This system is used at the East Rand Proprietary Mines, in the Transvaal. Twelve hours only is necessary to change a lining, the work being done by the regular tube-mill shiftman, working overtime. The life of an Osborn liner is about 300 days. One great advantage of this type is that thin iron wedges only are used, so there are no bolts to get loose and, consequently, no sloppy floors as with the El Oro liner. The total volume of a $5\frac{1}{2}$ x22-ft. tube mill is 523 cu.ft. and with new 6-in. liners is 350 cu.ft., holding $10\frac{1}{2}$ tons of pebbles

⁸"Eng. and Min. Journ.," Feb. 22, 1913.

⁹South African Assn. of Engrs., April, 1905.

¹⁰Textbook of Rand Metallurgical Practice.

⁷"Min. and Sci. Press," May and June, 1911.

(105 lb. to a cu.ft.) when filled 3 in. above center line. With a 3-in. liner it holds 12.8 tons and up to 14 tons as the lining wears.

KOMATA LINER WINNING FAVOR

The Komata liner¹¹, though not new, has been attracting some attention in Nevada of late. It consists of longitudinal ribs 18 in. apart, with plates between, $\frac{3}{8}$ in. thick at edges and 1 in. in the middle. The plates lasted in one case 75½ weeks and angle bars 60½ weeks, grinding 76 tons per day. The advantages claimed are maximum capacity, no slipping of pebbles, best metal distribution for greatest endurance, and as the lining does not alter shape much, the speed is nearly constant. F. C. Brown, in speaking of the advantages of this liner, gives for silex lining, consumption of flints and lining 3.61 lb., costing \$0.035; Komata liner and flints, 1.44 lb., costing \$0.017. Life of the liner was 80 weeks and the working area of a 4-ft. 10-in. by 19-ft. tube mill was increased 20% by its use. In this connection the experience at the Black Oak mill¹¹, in California, is interesting. A 5-ft. diameter by 18-ft. tube mill was lined with smooth cast-iron liners 13½ in. wide, but it did not do good work, so iron strips 3 in. wide and 2 in. thick, one to each alternate row of liners, was put in, and the efficiency improved. Then one strip to each row of liners was put in and the efficiency fell off. The number of strips was reduced again to one for each alternate row of liners and the efficiency improved once more. The addition of these strips improved the efficiency by 13½% and the life of the liners was lengthened. This proves the efficiency of the lifting power of the strips. The most effective crushing of hard grains is by impact, and the falling pebbles of a tube mill are like the falling stamp of a battery. The higher they are lifted and the more of them that are lifted, the more work there is done. The rounded grains of sand particles is evidence that there is some work done by abrasion, but it is probably not important except in extremely fine grinding.

The practice in the Tonopah⁸ district, in Nevada, is contrary to that in all other parts of the world. The operators there claim better results with smooth liners both as to character of product, its quantity and cost of production. Objections to silex are cost and time necessary to reline, about 24 hours in a well managed plant. However, at the Extension mill, at Tonopah, one tube mill is fitted with ribbed liners for coarse crushing and the other with smooth liners for fine crushing.

IRON BALLS FIRST USED IN TUBE MILLS

Iron balls were originally used as the crushing material, but were too expensive, so flint pebbles from the Danish coast were then tried and proved satisfactory. Since then, flint pebbles from other parts of the world have been successfully used. Selected pieces of ore were early tried and where hard and compact enough, answer very well. They have the advantage of being far cheaper and that no barren material is being crushed and treated. This is an important matter when it is considered that at some large plants on the Rand 2½% of the ore treated is tube-mill pebble.

For feeding the pebbles, at first the mill had to be stopped, the door taken off and the pebbles dropped or shoveled in from an upper platform, thereby losing an

hour or so of running time each day, with the added disadvantage that the mill part of the time either had too many or too few pebbles in it for efficient running. In Mexico this was overcome by Neal¹², using a reverse spiral at the discharge end and shoveling the pebbles into it, and also using a spiral at the feed end for the pulp. On the Rand¹⁰, Schmitt used a shallow chamber and an inner spiral attached to the feed end of the mill. Pebbles are fed by hand or automatically, along with the pulp. Other schemes in which a spiral plays an important part are used in different parts of the world.

At most modern tube-mill plants, the long axis of the tube mill is perpendicular to the long axis of the battery. They may be driven from either end, but the tail end seems preferable, giving plenty of room for classification, and pebble feeding. Also in case of overflows, sand does not get into the gears. In the past, belt drives from individual motors have been most popular, but of late several tube-mill plants have been installed in America with silent chain drives. The one at the Black Oak mill is a very neat arrangement, centers of motor and tube-mill pinion shaft are but 42 in. apart. No trouble was encountered and there was a considerable saving in power.

PROPER TUBE-MILL SPEED

The speed at which a tube mill should be driven depends on the diameter of the mill, and thickness of and type of liner used. With a ribbed liner it should be slower than with silex. H. A. White³, in speaking of a silex-lined mill, worked out mathematically 27.7 as the best speed for a 5-ft. tube mill and suggests that speed should be changed in proportion to the actual internal diameter of the tube mill as the liner wears, and would probably be based on average internal diameter. Davidson¹² gives $V = \frac{200}{\sqrt{D}}$, where $V =$ r.p.m. and D internal

diameter of mill in inches, as the correct speed for tube mills, and said that over 1000 had been installed on that basis. For a 5-ft. mill this works out at 26 r.p.m., whereas the makers recommend 28 r.p.m. as proper.

On the Rand, where it is not necessary to grind finer than to a point where 65 to 75% will pass a 90-mesh screen, heavy stamps, 1500 lb. and up, are used in combination with 5½x22-ft. tube mills. With this combination, a coarse screen on the battery has been found most economical. From 4-mesh to ½-in.-mesh screens are in use at large modern plants. A certain large mill on the Rand has 220 stamps of 1500 lb., and eight tube mills. It is divided into two district sections, one of which has 60 stamps and four tube mills, and the other 160 stamps and four tube mills. The first section averages a little better than 16 tons per stamp per day of about 0.3-in. material. The second section averages a little less than six tons per stamp of 30-mesh material, roughly, 960 tons per day in each case. There is surely as much — 90-mesh pulp leaving the battery in the second case as in the first, yet the final pulp delivered to the cyanide plant from each section of the mill is almost the same. It is rather finer from the 160 stamp section, but there is no great difference. There are few large mills in the world that can be arranged for making such a test.

At the Goldfield⁷ Consolidated, using 1050-lb. stamps and 5x22-ft. tube mills and grinding everything to pass

¹¹"Min. and Sci. Press," Nov. 30, 1912.

¹²T. M. M., 1904.

200-mesh, it is not considered advisable to feed coarse product to the tube mills. But it is thought, for that ore, more economical to crush to 4-mesh in the battery and then to 16-mesh in Chilean mills, and then feed this 16-mesh product to the tube mills for all sliming.

Due largely to Rand initiative, there has been a tendency the last few years to use heavier stamps and coarser screens on the batteries, and therefore use more tube mills. Even on the Rand, where a large portion of the tube-mill product is leached, newer plants are grinding finer, thus increasing the percentage of slime treated. This fine grinding has only been economical the last few years, due to improved methods of treating slime. The tube-mill product is sampled hourly and every morning a screen analysis made. The operator aims to obtain from 1 to 5% + 60-mesh material in his discharge. After a little practice he is able to judge, by feeling the pulp, to within 1/2% of the amount of this + 60-mesh product present.

TUBE-MILLING COSTS VARIABLE

Dowling⁹ gives the cost of tube milling as influenced by stamps per tube, mesh screen used, degree of reduc-

tion, and nature of the ore. In January, 1906, he states it as \$0.116 per ton, a very good figure for today. K. L. Graham¹³, using 5 1/2 x 22-ft. tube mills and 6 x 6 x 4-in. siliceous blocks on edge, gives a cost of \$752 to reline, and a life of four months, equal to \$6.07 per day. C. O. Schmitt, April, 1911, reported in the same journal, sends 3/8-in. product to tube mills, when a set of liners had a life of 70 days and cost \$510. Hutchinson gives the life of siliceous lining as seven months and cost \$691 to renew, \$593 of which is for supplies.

HARDINGE MILL FOR GRANULATING

In view of the growing importance of the Hardinge mill for fine grinding preparatory to copper concentration, it is interesting to see what success it has had in gold and silver milling. One was used at the O'Brien

mill, at Cobalt, and was not found good as a slimer. The *South African Mining Journal* says that an 8-ft. Hardinge mill was tested at the Village Deep and gave efficient results on a fine feed, but not with coarse particles. With 100-mesh screening (10 to linear inch), it does good work, but for the coarser mesh used on the Village Deep it was not as efficient as an ordinary cylindrical mill. L. M. Kniffen, in *Pacific Miner*, September, 1910, said he was unable to find sorting action of pebbles in an 8-ft. mill. He gave these results on a hard siliceous ore, with 30% moisture and discharge of 55% through 200-mesh, in kilos per minute: Allis-Chalmers 4 1/2 x 16-ft. tube mills, 0.30 kilo. Hardinge 8-ft. mill, 0.306 kilo. He believes that as a competitor it has no advantage over the tube mill, but thinks that, due to its greater diameter, it is better on a 4-mesh feed.

Bisbee Porphyry Deposits

By J. B. TENNEY*

The two most pronounced features in the geology of the district are the Dividend fault, roughly east and west,



Copper Queen main power house

Sacramento shaft

FIG. 1. SACRAMENTO HILL, BISBEE, ARIZ.

with a dip to the south, throwing pre-Cambrian schists on the north against Paleozoic limestones on the south, and the Sacramento hill porphyry stock intruded into the Dividend fault, and extending into both the schist and limestones. Most of the ore in the district lies in the limestone on the down-thrown side of the fault, and around the periphery of the porphyry stock. The porphyry ore, as so far developed, lies in the porphyry stock to the south of the fault.

Little work was done in the porphyry in the early days, and the general opinion was that it was barren. In 1908 the first serious prospecting was commenced, and all the ore has been developed since that time. In October, 1913, underground development was discontinued, and the ground is now being prospected by churn drill.

*Geological Department, Copper Queen Consolidated Mining Co., Bisbee, Ariz.

¹³Journ. Chem., Met. and Min. Soc., South Africa, April, 1907.

The surface geology of Sacramento hill is shown in Fig. 2. Extending roughly east and west, along the length of the hill, is an area of brecciated silica and hematite. The outlines of this breccia are extremely irregular, and the fragments show no orientation whatever. The contacts with recognizable porphyry are fairly sharp, and are usually stained with copper, the staining for the most part being on the porphyry side of the contact. The porphyry itself, to the south of the breccia, is heavily stained with iron and broken. To the north it is comparatively little altered and broken, and is very much less stained.

The underground development was pushed from two points, from the Sacramento shaft, at the east, and from the air shaft, at the west. From the Sacramento shaft, a body of ore has been blocked out, extending from the 400-ft. level to the 200-ft. level, and, approximately, 300 ft. by 100 ft. in cross-section, with an east and west trend. From the air shaft, a larger body has been developed, between the 200-ft. level and the 100-ft. level and above. Here also the ore has its long dimension east and west. An area about 800x200 ft. has been blocked out, of un-

would seem to fit the facts better than anything else. The richest ore developed is along a strong east and west break. Along this the ore is carried the farthest from the silica-breccia contact, but as it gets farther away, the

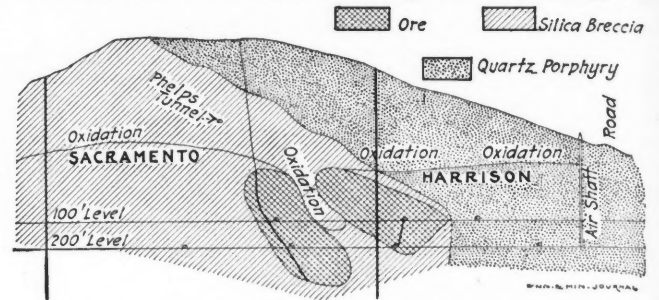


FIG. 3. SECTION THROUGH AIR-SHAFT OREBODY

ore diminishes both as to grade and amount, and finally pinches out altogether, although the break continues as strong as ever in barren porphyry.

The ore is typical of all disseminated deposits, consisting of chalcocite, some bornite and chalcopyrite, and considerable pyrite in a siliceous gangue. The absence of

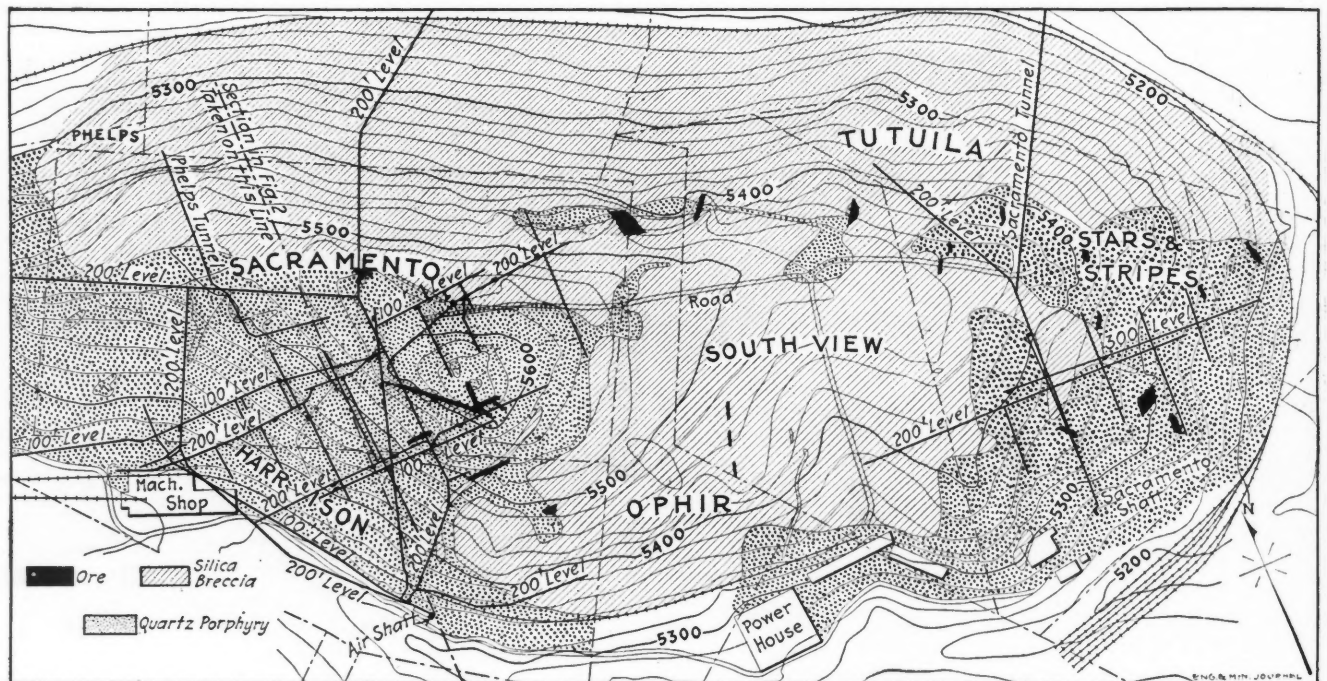


FIG. 2. GEOLOGY OF SACRAMENTO HILL, BISBEE, ARIZ.

usually good trade. As has been stated, underground development has been abandoned now for churn drilling. The drilling has not progressed far enough as yet to show definite results.

The most important point to work out in prospecting, is the relation of the silicified breccia mass, on the surface and underground, to the ore. From work done so far, most of the ore apparently lies near the contact of the breccia and the porphyry, in both rocks. Fig. 3 is a section taken north and south through the air-shaft orebody, and shows the apparent relation. Both underground and on the surface occasional porphyry fragments are found in the breccia, and the presumption is that it is an altered porphyry. The lack of orientation of the fragments, and the extreme irregularity of the contacts seem to indicate that it is not a fault breccia. The solution-breccia theory

oxides and carbonates in the oxidized zone is marked, the ore grading sharply from chalcocite into barren gossan.

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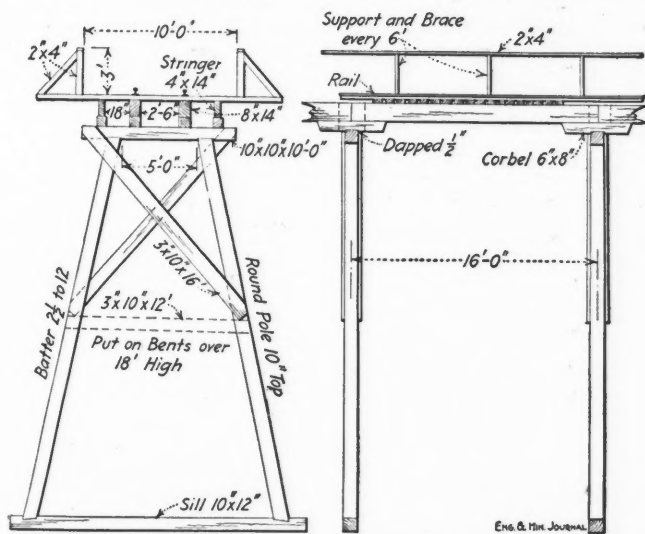
A Device for Cleaning Small Water-Service Pipes was described at a meeting of the New England Water Works Association on Feb. 11, reports "Engineering News." The author stated that the device was of benefit in cleaning out small pipes without the use of rods. A proving or testing pump is cut into the service pipe, usually in the cellar. This pump is capable of a high pressure, although in practice 200 lb. is rarely exceeded. In front of the pump is introduced a wad of any paper easily dissolved in water. This permits the pressure to accumulate as the force pump—which is usually fed from an ordinary hand pump drawing from a pail of water—starts operations. This plug of paper is slowly forced through the service pipe out into the main, thoroughly cleaning the service pipe. Cases where the pipe bore decreases as it approaches the main, and also where the cock at the main is all but closed from dirt and corrosion, have yielded to this method.

Details of Practical Mining

Wood Trestle for Motor Trammig

BY WILLIAM WALLACE*

From the typical iron-range shaft several trestles usually lead off, one or two for the ore stockpile, one for the waste rock and a short one for a tail track, when motor trammig is employed. The bents of these trestles are sometimes steel, more frequently wood, and in the latter case are often temporary. The accompanying illustration



CONSTRUCTION OF A TYPICAL TRAMMING TRESTLE

represents a rather typical bent of light construction. It is designed for a load of 10 tons, that is, a loaded car and an electric locomotive. The material specified is hemlock, except for the posts which are cedar, spruce, or tamarack round poles. Such a trestle will range in height from 15 to 50 ft., although for the higher structures, three or four posts are used in the bent. The stringers instead of being sawed timber, are frequently hewed poles, which may be lapped and the corbels eliminated. The full sill shown here is often omitted on a temporary bent and 1x6-ft. bearing blocks used under the various posts.

Quebec Fatal Mine Accidents

The death rate in Quebec mines for 1912 was 3.47 per 1000. The figure is based, as is correct practice, on an average of 300 days of work; that is, the rate is actually 3.47 per 300,000 shifts worked. In this way, the mine working less than the average number of shifts is not unduly favored. The total number of mine fatalities was 11, according to the 1912 "Report on Mining Operations." Five other deaths took place in quarries, brick-yards, clay pits and cement mills. Of the mine accidents, two were the result of a premature blast. A dry battery was being used for electric firing, and an accidental con-

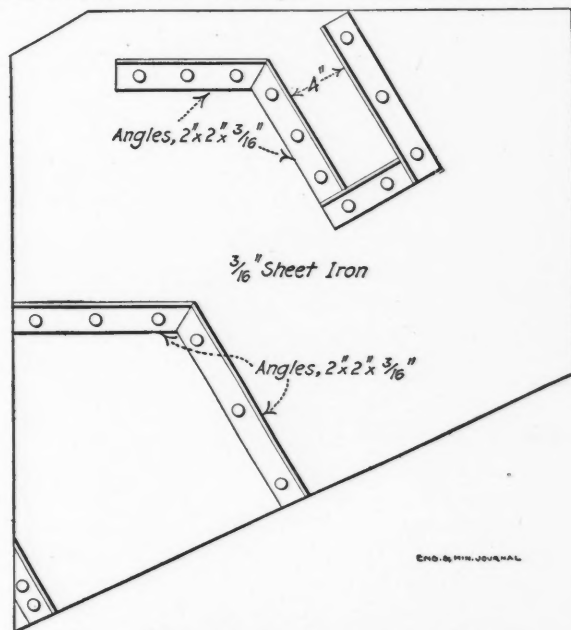
*Mining engineer, New York.

tact set off the blast. The obvious unsuitability of dry batteries for this work is thus emphasized. Of the accidents in the related industries noted, two men were killed by falls of rock from a quarry face and one was buried under a slide from a clay bank. It is recommended that all overhanging faces in quarries be avoided, that vertical faces should be permitted only in the case of solid rock, that their height should be limited by the amount of fissuring in the rock, that where rock is badly fissured or liable to disintegration, the face should be carried in benches, and that in sliding materials, such as clay, the natural angle of repose should not be exceeded and the longer slopes should be divided into benches.

Chute Reinforcement of Angles

BY ALBERT G. WOLF*

In mining by the shrinkage method, large boulders are often covered in the stopes. These boulders eventual-



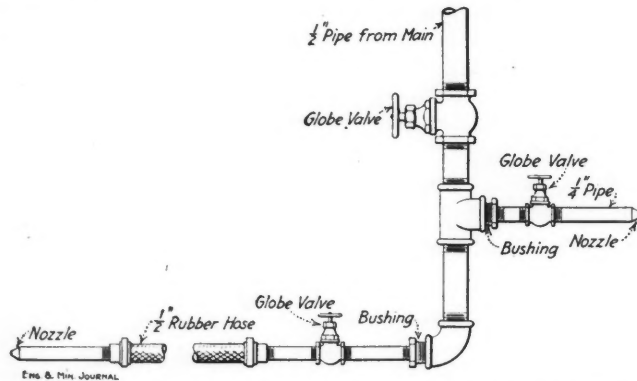
STEEL PROTECTION APPLIED TO CHUTE

ly work down to the chutes, and to remove them it is necessary to resort to blasting, which will weaken or destroy the chute timbers. A simple reinforcement against such injury is shown in the accompanying illustration. Pieces of $\frac{3}{16}$ -in. sheet iron are cut to fit the chute sides, and to this sheet iron are riveted pieces of $\frac{1}{2}$ x2-in. angles, forming both braces, and cleats to hold the chute boards. These sheets or liners are then fastened to the inner sides of the chutes by spiking or bolting. The exact length of the angle braces is immaterial. A piece of sheet iron covering the bottom of the chute will also add greatly to its life.

*Mining engineer, Mason, Nev.

Compressed-Air Jet for Cleaning

A simple, labor-saving device is shown in the accompanying illustration. Where many machine drills are being operated, much time may be saved to the repair man by using an air jet for cleaning various drill parts, such as cylinders, barrels, front heads and valve chests. A $\frac{1}{2}$ -in. pipe line is connected to the receiver or air main, wherever it is most convenient, and a line is run



ARRANGEMENTS OF AIR CLEANING-JETS IN THE SHOP

to the work bench. A globe valve is placed in the line, and below the valve, two $\frac{1}{4}$ -in. lines are taken off. One consists of a nipple, followed by a globe valve and a 1-ft. length of $\frac{1}{4}$ -in. pipe. The end of this piece is drawn out to form a nozzle. The other consists of a globe valve followed by a length of $\frac{1}{2}$ -in. rubber hose and a $\frac{1}{4}$ -in. nozzle. The first jet is convenient for cleaning small parts which are easily handled; the second for larger parts, or parts which may be clamped in the vise.

Electric-Air Drill Wagons

Temple-Ingersoll drill wagons at a gneiss quarry opened for the Kensico dam of the Catskill aqueduct, are putting in holes averaging about 40 ft. in depth. The holes are started at 5 in., and bottom at $3\frac{1}{2}$ in. A cross-bit is used (Bull. A. I. M. E., February, 1914). The drill wagon is supported on heavy planks placed on the ground, so that it is a simple matter to advance the wagon when a new set of holes is to be put in. Several holes may be drilled at one setting of the wagon, as the drill mechanism is mounted on a circular rotatable platform, allowing holes to be put in on either side and beyond the end of the wagon. The drill wagon has a vertical power feed of 6 ft., the drill traveling up and down in vertical guides, while a lighter and higher frame is used as a hoist for the steels. It takes them out of the hole at a single lift, except the longest pieces. The drill cylinder is 7 in. in diameter, has a 7-in. stroke, and strikes 350 blows per minute.

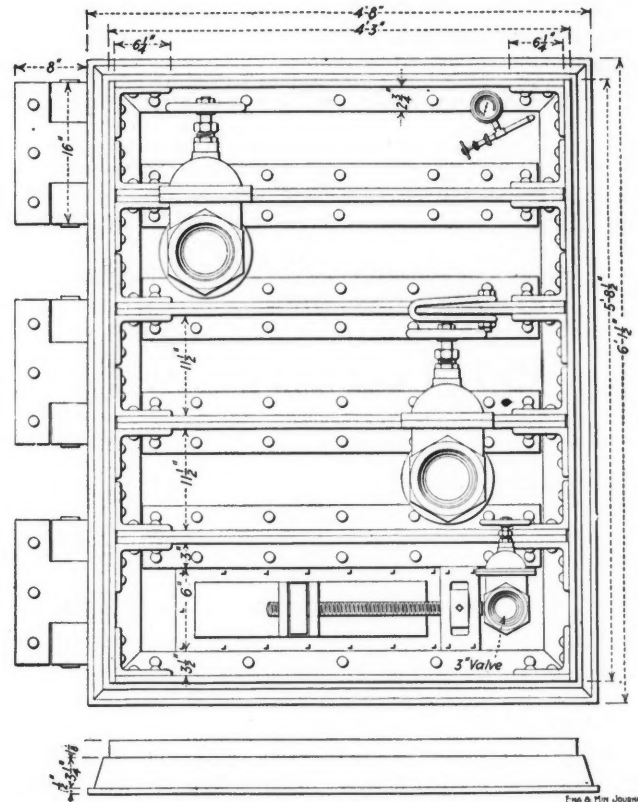
The pulsator and 12-hp. electric motor operating it are both mounted on the drill wagon. In other respects the arrangement and operation resemble an ordinary Temple-Ingersoll tripod drill outfit. By means of clutches, the motor drives the feed screw for the drill hoist and raises and lowers the steels; it also operates a winch which can be used to propel the wagon when its position must be changed.

One drill runner and a helper operate and handle the wagon. The shifts are 8 hr., and at the time of observation the drills were averaging about 40 or 50 ft. of hole per shift. The weather was oppressively hot, which probably accounted for the relatively slow progress, as it is understood that the progress was usually 45 to 65 ft. per shift and in a test as much as 104 ft. A constant stream of water is fed through a pipe beside the steel.

Built-Up Iron Water Door

BY R. R. HEAP*

A detailed description was given in the JOURNAL, Dec. 27, 1913, of the method adopted for draining an ore run



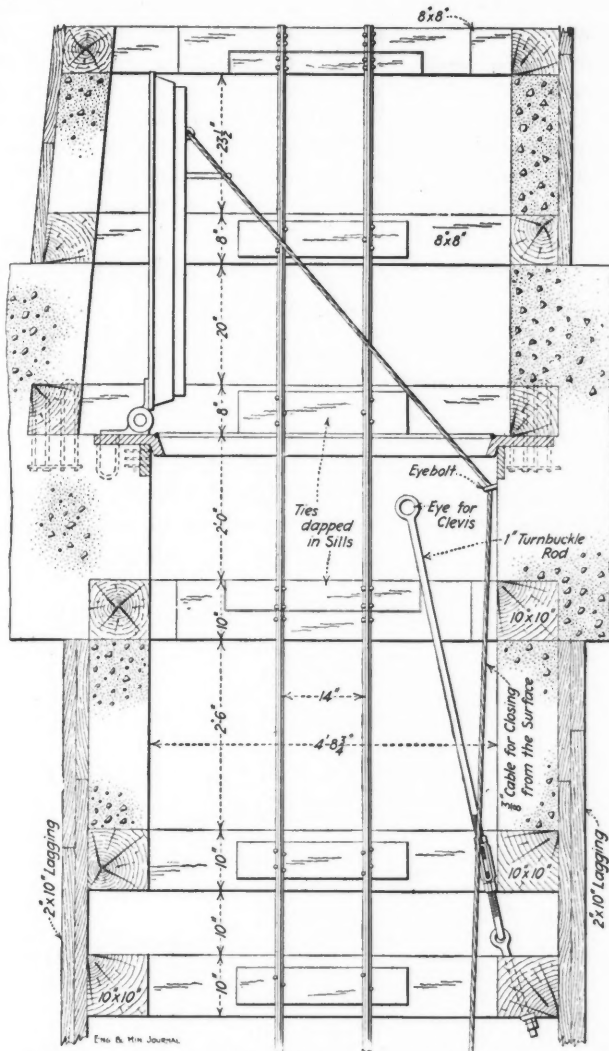
CONSTRUCTION OF DOOR AND ARRANGEMENT OF VALVES

near Miami, Okla. The problem involved the use of a bulkhead door to control the flow of water to the pump. This door, being one rather carefully designed, is here described. The drainage head was 50 ft., and the door was built to withstand a pressure in excess of requirements, which, however, gave to it extreme solidity of construction. Its width and height were determined by the opening necessary for tramping the ore to the shaft, at least 5 ft. 6 in. in height and 4 ft. in width. The Webb City and Carterville Foundry & Machine Works of Webb City, Mo., made the plans and built the door.

It was considered safest to regulate the volume of water flowing to the pump by means of a series of valves in the door, which were more than sufficient in total area to pass the entire volume of water; it would not have been advisable to regulate the volume of water by opening the door to any required width. The drawings show the construction and installation so clearly as to require pointing out only its most important features.

*Superintendent, Lennon Zinc & Lead Co. and Miami Zinc & Lead Co., Miami, Okla.

The door and frame were installed in shale. They were both made of heavy boiler iron with all joints securely riveted in place. The contact joints were beveled and lined with a metallic packing. To insure that the setting of the frame should be watertight, the drift at the point of installation was enlarged by cutting a space 4 ft. deep and 4 ft. wide on both sides of the drift in the floor and in the back.



DOOR SET IN THE DRIFT, CONCRETE LINING AND REMOVABLE TRACK

A set of timbers was then put up to which the frame was bolted level, and the open 4-ft. spaces filled in with a rich mixture of concrete, flush with the top of the sill, with the insides of the posts and with the bottom of the cap. The further precaution was taken of extending the concrete filling, flush with the insides of the timbers, for two sets in front and behind the door frame. The trackway through the door was made in a removable section, the 3x6-in. ties being fitted into daps cut out of the sills, so as to make a close joint and one easily and quickly movable.

Two 6-in. and one 3-in. iron body, brass mounted, wedge-pattern gate valves were screwed into flanges riveted to the inside of the door, using nipples just long enough to give room for the valve wheels. At the bottom a slide door was installed, arranged to be opened and

closed by means of a heavy air-drill square-threaded feed screw and nut, the nut tightened on the screw by a 5/8-in. setscrew and held in place in a slot 2 1/4 in. wide. The drawing shows the slide door tightly closed. Its maximum opening gives a space 6x12 in., more than sufficient with the 3-in. valve to pass the entire flow of water.

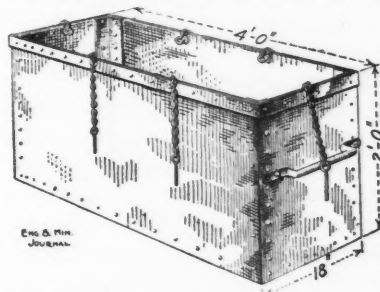
The door was held tightly closed with a 1-in. turnbuckle rod, fastened with an eyebolt on one end to a post of the third set back and at the other end to the door with a heavy clevis of 1 1/8-in. round iron. This clevis was fastened to the door at one of the upper joints by a 3/4-in. king bolt slipped through the eyes in the clevis and the 7/8-in. hole in the door joint. With the clevis in place a few turns to the right of the turnbuckle securely tightened the door; a few turns to the left gave ample play easily to pull out the clevis bolt; after slipping the clevis from the large eye in the end of the rod, the latter would swing down out of the way on the side of the drift and the door would open. An offset in the drift allowed the door to swing back out of the way.

A means of closing the door from the surface was also provided; a small 3/8-in. cable was fastened to the door at the top and passed through two eyebolts, one on the side of the drift and one at the corner of the shaft. On the surface it was fastened to a post of the headframe. By means of a loop in this cable it could be hooked into the hoisting cable snap-hook and tightened with the hoist. The door was closed thus in a test drill, but the method as yet has never been necessary in operating.

The valve of such a door, as permitting the successful use of a single pumping unit is evident. The series of valves is of great importance as an efficient means for regulating the flow of water and of eliminating the danger of flooding the pump, which might occur under certain conditions were the size of the opening of the door itself the only gage.

Box for Spent Carbide

A common charge against the carbide lamp is that it is messy. The spent carbide is usually thrown out wherever the miner chooses and is both ill-smelling and un-



IRON BOX FOR ACETYLENE-LAMP EMPTYINGS

sightly. At the Schley mine, on the Mesabi range, a special iron box is provided. The box is made of steel plates riveted to angles at the corners and bound with a strap at the top. Attached to the top by short chains are six cleaning rods with which the frequently wet and sticky material can be scraped from the lamp. Such a box makes for neatness and efficiency.

Water in Sand Pulp for Mine Filling

In sand filling it is possible to transfer the sand residue to the pump by shoveling from the tanks through the discharge doors into a launder down which water flows (*Journ. Chem., Met. and Min. Soc. of South Africa*, September, 1913). While trial has shown this method to be practicable, yet the limited grade available for launders in most existing sand plants requires a much higher ratio of water to solid for the pulp to flow by gravity than is needed for subsequent pumping, and, of course, still more than is desirable for lowering underground. The same consideration applies to hydraulicking the sand out of the tank, in addition to the liability of driving slime through the filter cloth. If discharge to the dump is necessary at times, it is essential that cars or belts under the tanks should not be interfered with by launders.

An excess of water is undesirable as causing a nonuniform deposit of sand underground; in addition, when surface transport by pumping is practiced, the power consumption is increased by superfluous water; and both in pipes and in launders a more fluid pulp increases the velocity and the wear by abrasion. A pipe has been in use with thick pulp at the Simmer & Jack for upward of three years without appreciable signs of wear. The amount of drainage water underground increases rapidly with fluid pulp; nearly three times as much has to be handled from a pulp containing 50% as from pulp containing 30% moisture.

In the transport of sand residue as pulp, the water serves essentially as a transporting medium, and its ratio to solids should be kept as low as compatible with serving this purpose. A sand pulp may be pumped by a centrifugal pump up a short vertical pipe with as low a ratio by weight as one of water to one of sand, but for pumping any distance on an incline, it is usually necessary to employ a 2:1 ratio. Where the velocity is insufficient the pyritic particles are liable to settle, and periodical pumping of water is necessary to prevent choking. The delivery pipe on the down grade works well with a fall of 3.5%, so that acting as a launder it may clear itself on cessation of pumping. In a rising pipe the vertical component of the velocity should be greater than the rate of fall of the coarse pyritic particles. A horizontal delivery pipe is undesirable, as a high velocity of pulp is required to prevent settlement. Pipe grade and water ratio are, within limits, inversely proportional; the steeper the grades practicable, the less water need be used. The coarseness of the sand residue is also a factor, since the finer the particles the lower the velocity required. When possible a vertical rising pipe from the pump, with a uniform down grade from its highest point, constitutes a satisfactory arrangement, as does also a steep up grade to the point of delivery. It is, of course, essential that there should be no pockets or flats, as any unfavorable grades affect the whole operation.

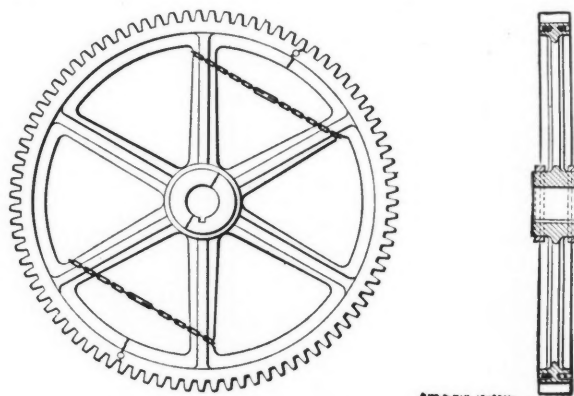
The launder grade required for the sand pulp is dependent upon the size of the sand particles, the ratio of water to solids, the volume of the pulp and the internal shape and surface of the launder, while the head of a launder and any curves require a higher grade than the average. In general, an ordinary sand pulp containing 30% moisture will flow slowly but without difficulty on a

30% grade, with 40% moisture on a 20% grade, and with 60% moisture on a 10% grade.

The water ratio in pulp, besides determining the size of pumps and piping and the power consumption, also affects the number of dewatering cone classifiers employed. With an inflow pulp having a 2:1 water ratio, a diaphragm cone, 8 ft. in diameter by 10 ft. deep, will deliver 10 tons to 12 tons of sand as a thick, 30% moisture, pulp underflow per hour, if slime has been adequately removed from the sand before its cyanide treatment. If, however, the sand residue contains much colloidal slime so as to form a viscous deposit in the cone, the capacity of the classifier may be reduced by one-third or more. If a return of the overflow by pumping is necessary, any additional water necessitated by unfavorable pipe-line grades constitutes a constant source of expense.

Repair to Spur of Electric Hoist

An emergency repair on a broken gear of an underground electric hoist is described by T. D. Parfitt in *Power*, Jan. 6, 1914. The accident was not discovered until the night shift went on duty. As there was no duplicate of the wheel, and it was not permissible to lose much time, the pieces were brought out to the blacksmith shop, laid on the floor and leveled up so that the frac-



QUICK REPAIR FOR BROKEN GEAR

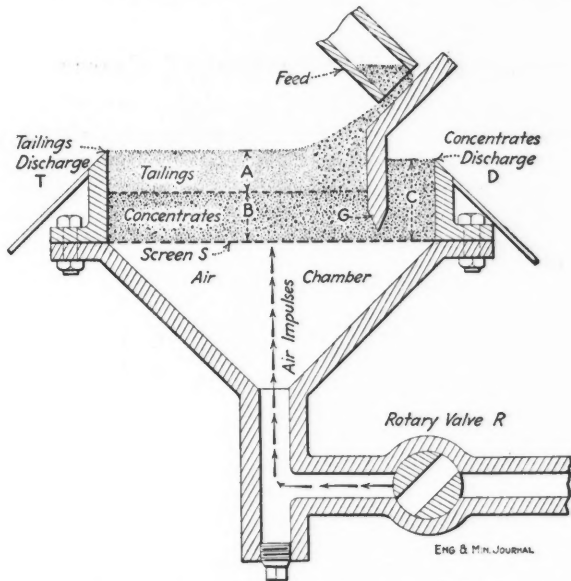
tures would come well together. A piece of 1/2-in. chain with a 1-in. turnbuckle was put around two of the arms on each side of the hub as shown, nicks being cut on the arms to prevent the chains from slipping. A strong ring was then shrunk on each side of the hub; this pulled the wheel together until the cracks were hardly perceptible. Some holes were drilled through the wheel rim right in the cracks and were tapped for 3/4-in. bolts on both sides of the wheel; the bolts pulled up tight prevented any side movement of the broken halves. The main dimensions of the wheel are as follows: Diameter, 68 in.; width of face, 6 in.; length of hub, 8 in.; bore, 5 in. The job took about six hours, and the wheel is still running without showing any signs of weakness after six months.

Sand Is Returned as Mine Filling About Two Weeks After It Is Hoisted Out as Ore at the Simmer & Jack mine on Rand (*Journ., Chem., Met. & Min. Soc. of South Africa*, September, 1913). This results from the utilization of current sand residue direct from the tanks, the cyanide being destroyed with permanganate. It is a coincidence that two tons of ore occupying about 24 cu.ft. of space in place yields about the same volume of sand for return as filling, provided that the ore has been well crushed and classified into 50% by weight each of sand and slime.

Details of Metallurgical Practice

The Plumb Pneumatic Jig

The description in the JOURNAL of Dec. 6, 1913, of this machine presented a good résumé of its character, but the accompanying sectional drawing adds somewhat



SECTION OF PLUMB PNEUMATIC JIG

to a clearer understanding. This drawing shows only the actual separating part of the machine, including the screen and bed, tailings and concentrates discharge and the rotary valve controlling the air admission. The machine is constructed wholly of cast iron, steel and brass.

Flotation Tests on Antimonial Silver Ore

Flotation tests on a certain antimonial silver ore were conducted by Donald G. Campbell to determine the efficiency of this method of concentration. The ore in question had a siliceous gangue, and the valuable mineral was in the form of stibnite and stephanite, finely disseminated through the gangue. The results of these tests are summarized by Mr. Campbell in the School of Mines Quarterly for November, 1913, as follows:

(1) Of the oils tested, pine-tar oil is the most effective froth producer, and seems to be most efficient when used in quantities approximating 0.1% of the ore.

(2) Without acid, the froth produced is nonselective; that is, the gangue is carried up into the froth almost impartially with the valuable mineral. As acid is added, the percentage of recovery may be diminished also, but the concentration is much more satisfactory. The amount of strong sulphuric acid that seems to produce the best results is approximately 0.4% of the ore.

(3) For good extraction, a rapid agitation must be obtained, a peripheral speed of 1100 to 1200 ft. per min. of the agitator blades being necessary.

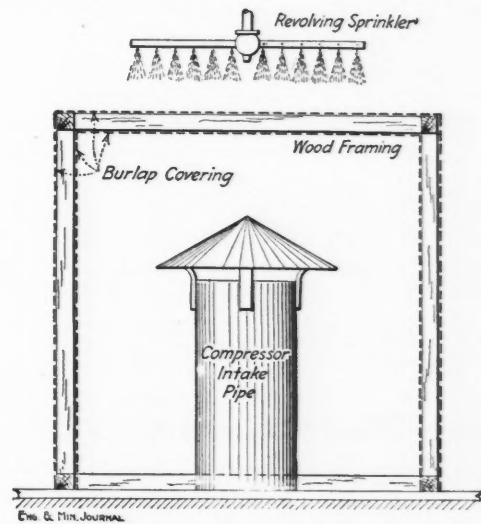
(4) As the temperature is increased, the extraction is also increased, and the amount of oil necessary, as well as the time of agitation, may be diminished somewhat. The amount of the gangue carried into the froth is also greatly lessened, giving a much purer concentrate.

Compressor Precooler and Scrubber

BY FRANK RICHARDS*

I was much interested in the sketch and description in the JOURNAL of Sept. 6, p. 449, of the device employed by the Broken Hill South company, in Australia, as an air precooler and scrubber. The essential element of the arrangement was a vertical cylindrical shell through which the air passed upward, meeting a downwardly projected spray of water, and then a perforated baffle plate, the water to cool the air, and the baffle plate to intercept the dust and other foreign material.

Getting the free air to the compressor and getting it into the compressor as cool and as clean as possible cannot be too strongly insisted upon, and the arrangement spoken of is to be commended at least for the intention embodied, although it would seem to be hardly as efficient



COMPRESSOR PRECOOLER

as it might be for the complete accomplishing of the purpose intended. There is the additional objection that it would seem to be too elaborate and expensive; so much so that it might tend to deter some operators from pre-cooling and filtering their air, as they ought to do. The apparatus, as described, could not fail to have a good effect upon the air passing through it, but neither the cooling of the air nor the thorough cleaning of it by the removal of the dust and foreign matter can be done instantaneously and at one precise point of its flow for each operation, as assumed. If the upright shell had been entirely filled

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with some loosely packed porous material, such as coke, and if there had been provided at the top a little stream of water sufficient to keep the coke constantly saturated, and if the air had been so piped as to flow up among the coke in a leisurely way, it would have been both well cooled and well cleaned. It might be necessary to wash the coke occasionally by sending through it a strong stream of water, or the coke might sometimes need renewing, but this could be provided for.

I have already described in print a device, a sketch of which is here reproduced, which is much cheaper than the one mentioned, and which has proved effective and satisfactory. In this case there is a vertical air pipe of sufficient capacity liberally to supply the compressor intake, standing, say a foot or more, above the ground, with a hood over it which does not interfere with the free flow of the air, but keeps things from dropping in it. This pipe is outside the compressor room and is continued underground to connect with the compressor intake inside.

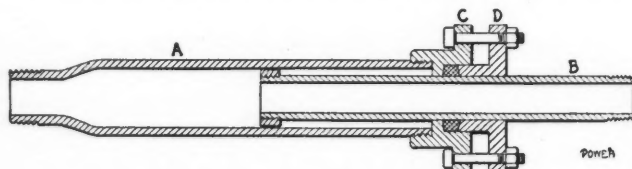
Over this vertical pipe is a wooden frame of cubical outline, measuring, say a yard in each dimension, and made of lumber about 2 in. square, and covered all over, except the bottom, with burlap, both inside the frame and outside, making two thicknesses of filter for the air to pass through. To complete the rig there is suspended over the center a lazily rotating lawn sprinkler and the little water that it delivers keeps all the burlap surface always saturated.

This arrangement, as was said, gave satisfactory results, and it happened to be located in one of the dirtiest and hottest regions of the United States. When the burlap became choked with the dust, as frequently happened, the frame was lifted off and thoroughly soused both inside and out with water from a hose, which in a few minutes made it as good as new.

It scarcely needs to be remarked here that the dampening of the intake air by this or any other process has no effect upon the quantity of moisture in the air after compression, because in any case when air is compressed to six or eight atmospheres and recooled to normal temperature, it will have more water than it can carry, and arrangements must be made for draining it, or for allowing it, as we might say, to dry itself, to discuss which matter would make this article too long, but it is happily coming to be better understood every day.

Home-Made Expansion Joint

The accompanying illustration (*Power*, Dec. 30, 1913) shows a 3-in. expansion joint which is satisfactory in service and economical to manufacture and has an advan-



SECTION OF LONG EXPANSION JOINT

tage over the type usually used in that it may be made for any length of stroke without great additional expense.

The sleeve *A* is a piece of 4-in. pipe with a standard thread on one end and swaged to 3 in. with standard 3-in. thread on the other end. The plunger *B* is a piece

of 3-in. pipe with a standard thread on each end. One end is for the pipe coupling and the other is screwed into a short ring to prevent the plunger drawing entirely out of the joint. This plunger is trued up and polished on the outside between the threads. On the 4-in. end of the sleeve *A* is screwed the flange *C*, which is bored out for packing and fits over the plunger *B*. The flange *D* forms the gland for the packing box and is bored to fit freely over the plunger *B*. Both flanges are drilled for four $\frac{5}{8}$ -in. bolts for drawing up the packing. Plunger *B* is free to slide back and forth the distance between the coupling on one end and the ring on the other.

Joining and Shape of Launder

The transport of pulp by gravity in open channels or launders and in closed channels or pipes is a simple matter, but, unless the plant is properly designed, either wear results from an excessive velocity, due to an unnecessary grade with a consequent waste of power where a previous elevation has taken place, or the rate of flow is insuffi-

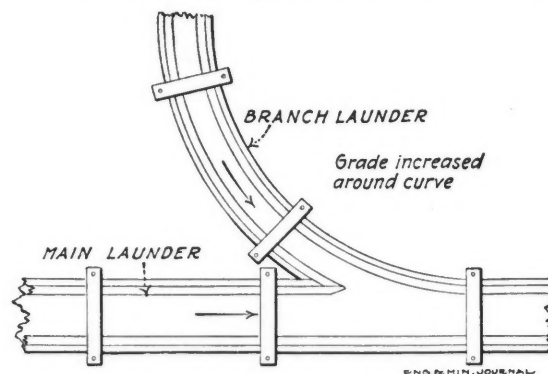
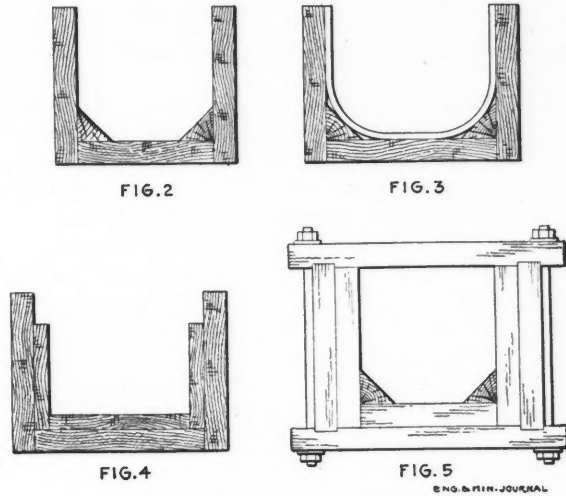


FIG. 1. APPROVED JOINING OF LAUNDERS

cient, and banking up of the solid matter takes place, due to a lack of grade. In the former case, the trouble can, in most cases, be rectified in various ways with beneficial results, while, in the latter case, more water will be required, which is undesirable, as it means extra expenditure for handling the water, or, with previous elevation of the pulp, matters must be rectified by elevating to a greater height. However, it is generally possible to find the most suitable grades for launders and pipes from the results of previous practice, bearing in mind the special conditions to be dealt with.

It is quite impossible to give a general rule dealing with every possible contingency. With launder grades given in the accompanying table, the pulp will flow at a velocity of from 7 to 10 ft. per sec. It may be taken that the pulp flows more freely on a metal surface than on wood, but the difference is not great, probably not exceeding 10% in favor of the metal surface. If pipes are used, the grade given for launders can only be applied if the pulp does not fill the whole pipe, as, should the pulp fill the pipe entirely, the benefit that might be derived from the head available is sometimes taken up by the extra friction, so that a lower velocity, and possibly choking up, may result. The flow of pulp in launders lined with cement is approximately the same as in wood launders, and the same applies to launders lined with rubber belt, while lining with canvas belt will decrease the velocity. All launders should, at their commencement,

have a steeper grade than the average, as the pulp requires to be accelerated. In every case, launders should be laid with a margin in hand, as the ratio of water to ore is liable to vary either accidentally, as the result of neg-



SECTION OF WOODEN LAUNDERS

lect in the crushing plant, or purposely, due to a change in the method of crushing. Other things being equal, a greater volume of pulp flows more freely than a smaller volume, and this must be taken into account when consid-

and, in addition, the grade in the curve should be greater than that of the straight launder, from 1 to 2% extra grade being desirable. The height so lost does not, if the number of turns is kept within reasonable limits, increase the total head much and it saves trouble.

The shape of a launder should approach a semi-circle, so as to reduce the wetted surface to a minimum. In practice when using timber launders this is not always possible, hence corner pieces are provided as shown in Fig. 2. Wooden launders lined with belting can be made to approach the semi-circular launder closely, as shown in Fig. 3. The depth of the pulp flowing in a launder should be equal to the width, so that the total depth of the launder should be greater than the width. In practice, this rule is most conspicuous by its absence. All wood launders carrying pulp containing coarse particles should be lined on the bottom and to a depth slightly exceeding the average depth of the pulp, and, unless lined with belting, as shown in Fig. 3, can be lined with wood, Fig. 4.

Launders lined with concrete, besides being desirable because of the wearing qualities, possess the advantage that the semicircular shape can be most readily obtained, particularly if the shell of the launder is made of steel, as shown in Fig. 6. Such launders can be made in sections, so as to permit of preparing a section when needed, besides facilitating the erection. It is sometimes possible to make such launders below the ground level by a cutting in the rock faced with cement. This is a satisfactory

GRADES FOR LAUNDERS AND PIPES IN MILLS

Mill launders.....	Screening used, holes per sq.in.....	9	16	25	64	100	225	400	625	900	1600
	Grade of launder.....	11%	10%	9%	8%	7%	6%	5%	4%	3 1/2%	3%
Battery tables.....	Grade.....						11%		10%		9%
Tube-mill circuit.....	Underflow of tube-mill classifier from 10 to 25%.										
	Shaking amalgamating plates, 10%.										
	Stationary amalgamating plates, 18%.										
	Return from shaking amalgamating plates to pulp elevator, 10%.										
	Percentage of +60 in final pulp.....						Under 10	10 to 20	20 to 40	Over 40	
Cyanide plant.....	Overflow of tube-mill classifier, grade.....						3%	3 1/2%	3 1/2%	4%	
	Underflow of slime classifier, sand pulp, grade.....						4%	4 1/2%	4 1/2%	5%	
	Overflow of slime classifier, slime pulp, grade, 1 1/2% to 1 1/4%.										
	Overflow of return-sand classifier, grade, 1% to 1 1/2%.										
	Underflow of return sand classifier, grade, 4% to 5%, depending upon percentage of moisture.										
	Return water launder, grade, 1%.										
	Leaching pipes from sand-treatment plant to precipitating plant, grade, 1%.										

ering main launders at different points of their length, although, unless the additional pulp is led to the main stream in a rational manner, the benefits to be derived from the greater volume of pulp may be wiped out by the disturbance of the flow due to this launder. In no case, states C. O. Schmitt, in "A Textbook of Rand Metallurgical Practice," Vol. 2, should a subsidiary or branch launder join the main launder at a right angle, but arrangements should be made that, when joining, the two streams flow in the same direction at the same velocity. Fig. 1, in the accompanying illustration, shows the correct method. It is also essential that the bottom of the two launders should be on the same level, as a vertical drop means a loss of velocity, and in the case of launders joining, the pulp entering will intersect the flow of the main pipe, resulting in a banking up of the crushed ore. Once an accumulation of sand has taken place, it will rapidly increase and the launder will overflow.

Curves in launders should be avoided where possible, but if a change in direction must take place, it should be obtained gradually and by a well designed curve. In no case should a right-angle turn be effected by means of a sharp corner. A curve with a long radius is essential, and the trouble taken will be paid for by reduced wear and a saving in grade. Curves should have a radius equivalent to at least 10 times the width of the launder,

method, but it is not always possible. Lining of launders by rubber belting considerably increases the first cost, but is amply justified by the longer life obtained. The wooden launder without lining is the cheapest form of launder, but its life is limited.

When pipes are used for the transportation of pulp by gravity, they should be so arranged that they can be

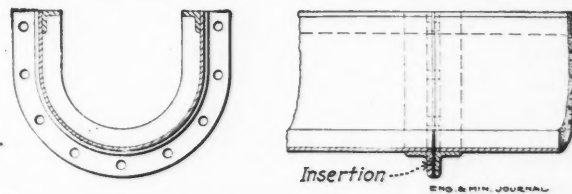


FIG. 6. DETAILS OF STEEL AND CONCRETE LAUNDRER

turned, in order to obtain a fresh wearing surface when worn on the bottom in the original position. Pipes used for this purpose should be laid in the grades sufficient to insure self-emptying in case the flow of the pulp is interrupted; otherwise, the heavier particles are liable to settle, and, if left beyond a certain length of time, will form a hard crust, which will remain and decrease the available area. Pipes wear out rapidly when used for coarse pulp and, unless special considerations render their use necessary, launders should be preferred.

The Cost of Doing Things

Cost of Steam-Driven Compressor Plant

The actual costs of the various items entering into the construction of a small power plant are herewith presented. No overhead costs, such as management, are included. The work was directly supervised by an erector at \$5 per day, his wages being distributed over the various items. The plant consisted of a steam-driven compressor, boiler, building, coal bin, two surface air-transmission lines, and accessories. Freight rates to the nearest railroad point were high and all the material for the plant had to be hauled at least two miles against an average grade of about $7\frac{1}{2}\%$ and a maximum of 20%.

The building was placed on a gentle side hill. Excavation required the removal of about 1560 cu.yd. of rail, clay and hardpan an average distance of 150 ft. It was broken out with a pick and bar and occasionally a little black powder was used. The area excavated was 75x75 ft. and the maximum depth was 16 ft. This work cost \$878 in labor and \$7 for powder.

The boiler room was 26x36 ft. by 16 ft. high at the eaves, with one heavy roof truss of 6x8-in. stuff in the center. The engine room was 28x32 ft. by 12 ft. high at the eaves, with two heavy roof trusses of 6x8-in. material. The studding was 2x8 in. The two buildings were contiguous with one door between. There were three other doors and four windows altogether. The building was sheathed and roofed with corrugated iron. The building was erected by a contractor for \$900, including everything except the floor which was laid later. The work was well done, but could have been done more cheaply by days' pay. The engine room was larger than absolutely necessary, space being left for additional machinery, such as a generator.

The boilers were of the fire-tube suspension type, of Kewanee make. The two units of 80 hp. each cost \$2075 set down at the plant; each had a separate stack. The setting involved the use of 27,000 red brick at \$18.62 per M., 4500 firebrick at \$44.84, together with fireclay, cement, sand and lime. These materials cost \$951. The labor of setting included that of a mason at \$6 and a helper at \$4, employed for 15 days on bricking. The total labor of setting cost \$437. The boiler foundations contained $16\frac{1}{2}$ cu.yd. of 1:3:6 concrete, the cement costing \$2.88 per bbl. and sand about \$2.50 per cu.yd. The cost of foundation materials was \$202, and the labor of construction was \$220.

The compressor was a duplex machine of well known make with compound air and compound steam ends. It was rated at 870 cu.ft. at 150 r.p.m. compressing to 100 lb. Its dimensions were 12-20 by 20 by 11-16-in. It cost, laid down at the plant and unloaded, \$3743. The labor of setting cost \$60. Its foundation contained 18 cu.yd. of the same concrete as the boiler foundation, costing \$229 for materials and \$127 for labor, including considerable excavating to get a satisfactory footing.

One of the air lines, to a distant tunnel, was 5000 ft. in length, including that part laid inside the tunnel. It was of 4-in. steel line pipe, with recessed couplings and with flange unions every five lengths, or approximately every 100 ft. There were 15 slip joints set at various points and three 30x48-in. receivers at important low points to catch water. The line went straight over several ridges and the delivery of the pipe by wagon, and dragging as well as its handling and assembling on the hillsides was extremely expensive. The line required a good deal of anchoring and some small light bridges were erected. The cost of the pipe and accessories, set down by wagon at various points, was \$2286. The labor of assembling was \$1072. Another 100 ft. of 4-in. pipe was laid from the receiver to an old $2\frac{1}{2}$ -in. pipe leading to a near-by tunnel. This cost \$64 for material and \$25 for labor.

The water tanks included one for storage above the power plant, 11 ft. high by 7 ft. in diameter, and another in the boiler room 4x4 ft., both of galvanized iron. The cost of these including 100 ft. of outside piping and $\frac{2}{3}$ cu.yd. of concrete for the smaller tank foundation was \$107. The labor of assembling the large tank with solder and rivets, of excavating for its foundation, of setting both tanks and connecting outside the building, was \$47. The indoor piping including all that was necessary for the steam, water and air on the compressor receiver, tank, boilers, pumps and heater, with fittings, valves and jacketing on the steam pipes and boiler tops. The material cost \$988, the labor cost \$223. The main air receiver was 4x12 ft., set vertically in the engine room. It cost \$181 delivered and cost \$13 to set.

The feed-water heater was of the Kewanee closed type, rated at 150 hp., costing \$145 delivered and \$15 to erect. There were two boiler-feed pumps of duplex type $4\frac{1}{2}$ and 4 by $2\frac{3}{4}$ in., set on a 3-cu.ft. concrete foundation. They cost, laid down, \$135 and cost to set, \$12.

A coal bin was built across one end of the boiler room outside, its bottom raised 10 ft. above the ground so that cleaning rods for the boilers could be manipulated underneath it, the boiler fronts being close to the end of the building. It had a capacity of about 50 tons. It was constructed of 6x8-in. and 8x8-in. stuff bolted and tied. It had a 5-in. sloping bottom and 4-in. front and sides, with one chute to the boiler room. The materials cost \$178; the labor cost was \$124.

Concrete 4 in. thick was laid for a floor on the unoccupied portions of the boiler and engine rooms, covering altogether 1250 sq.ft., costing for materials \$41, for labor, \$65. A gasoline lighting outfit using hollow wire and incandescent mantles was bought. It supplied three lights and cost \$33 and \$4 to install. A locker, shower bath, oil cupboard, etc., cost \$12 for materials and \$25 for labor. A large miscellaneous item was made up of tools and machines of which the mine had a poor outfit when the work was begun. This purchase was charged against its power plant, although it was subsequently used for other work. It included a Forbes pipe machine,

a handy winch, triplex chain block, rope, blocks, jacks, wrenches, chain tongs, drills, vises, bars, wheelbarrows, grindstones, small tools, etc. The cost was \$959, total.

The cost of the plant was rather high. It could be duplicated at a saving and could have been smaller and more cheaply built at the expense of quality. This is true, however, of most construction, and it is interesting to publish ordinary costs occasionally as against exceptionally low ones.

Construction Costs of the Nipissing Low-Grade Mill

Excavations for the new low-grade mine of the Nipissing Mining Co., Ltd., were started in November, 1911, construction having been completed about a year later. The accompanying data of costs are given by James Johnston in an article describing the mill in Bull. A. I. M. E., January, 1914.

WORK ON TANK-FLOOR LEVEL

	Soil Work, 2404 cu.yd.	Rock Work, 3144 cu.yd.
Labor.....	\$1369.00	\$5539.00
Sundry supplies.....	59.76	123.52
Teaming.....	6.03	.....
Blacksmith shop.....	17.60	102.75
Explosives.....	.....	279.41
Air drills.....	.....	1196.32
Hauling rock to dump.....	.....	1503.68
Lumber.....	.....	25.50
Total.....	\$1452.39	\$8770.18
Per cu.yd.....	0.604	2.79

Soil work on other grades cost 41c. per cu.yd., and rock work \$1.48 per cu.yd. The distribution of cost is about as shown in the table.

Walls and foundations are of concrete. The concrete plant was placed above the upper floor level, and chutes conveyed the mixed material to the forms at the points of use. A mixture of cement, sand and stone in 1:3:5 proportion was used, together with all the large stone the concrete would take. Battery, tube-mill and other foundations which are subjected to vibration, were strengthened in the upper foot or two with a greater proportion of cement.

COST OF CONCRETE WORK

Battery Foundations and Walls for Building and Ore Bins		Retaining Walls and Sundry Small Walls and Foundations on Tank Floor
Battery block = 846 cu.yd. concrete		
Building and walls = 349 cu.yd. concrete		
Total.....	1195 cu.yd., used 945 bbl. cement	434 cu.yd., used 485 bbl. cement
Labor.....	\$2669.48	\$1645.57
Supplies.....	3735.33	2152.52
Lumber.....	246.57	337.76
Carpenter shop labor.....	790.86	1180.05
Machine shop labor.....	87.78	26.09
Teaming.....	139.34	26.33
Fuel.....	12.85	12.85
Air for operating machinery.....	400.00	300.00
Total.....	\$8082.21	\$5681.17
	\$6.76 per cu.yd.	\$13.09 per cu.yd.

Cement was shipped to the mill in bags, four to the barrel, the total consumption having been 3355 bbl., at an average cost of \$2.06 per bbl. The various forms for concrete about the mill consumed 26,339 ft., b.m., of 1-in. boards, and 20,771 ft., b.m., of lumber of other sizes, which was afterward used for other purposes.

The mill building is of wood framing covered with 1-in. boards, building paper and corrugated iron, making it comfortable for winter service. In its construction 398,601 ft., b.m., of lumber was used, of which 148,250 ft. was 1-in. boards. The total of lumber used in the whole mill was 1,199,206 ft., b.m., which cost \$23,731.33. In the accompanying table is given the complete cost of the

mill. The accounts were closed three months after the mill went into operation, so that all adjustments and charges are included. The second section of the table shows the portion of cost charged to the construction which is essential, but aside from the mill proper.

COST OF CONSTRUCTION OF THE LOW-GRADE ORE MILL (CRUSHING AND CYANIDING SECTION)

Departments	Cost to Jan. 31, 1913
Store and office buildings.....	\$725.65
Proportion office and supervision during construction.....	6,652.97
Excavations.....	29,728.30
Foundations.....	20,159.39
Buildings over mill.....	24,618.99
Battery equipment.....	24,241.42
Battery equipment, proportion electrical equipment.....	5,267.38
Tube mills and classifiers.....	23,223.80
Tube mills and classifiers, proportion electrical equipment.....	12,091.02
Slime treatment and storages.....	31,519.84
Slime treatment and storages, proportion electrical equipment.....	4,477.26
Cyanide filter plant.....	14,154.92
Cyanide filter plant, proportion electrical equipment.....	3,040.71
Piping, pumps, etc.....	12,886.19
Precipitation.....	9,989.23
Precipitation, proportion electrical equipment.....	239.42
Heating plant.....	12,333.79
Water service.....	5,288.57
Water service, proportion electrical equipment.....	1,028.13
	\$241,666.89

To this cost was added later the installation of the intermediate filtering and desulphurizing equipment, not included in original estimate..... 13,172.63

Total cost of mill..... \$254,839.52

TRAM LINES, WASHING PLANT, ETC., SECTION

Departments	Cost to Jan. 31, 1913
Crushing, sorting, and jigging.....	\$25,836.64
Crushing, sorting, and jigging, proportion electrical equipment.....	2,274.55
Meyer crushing section.....	5,945.98
Tram lines, aerial.....	18,299.05
Tram lines, Kendall.....	6,499.61
Fixing roads.....	4,386.02
Workshops.....	4,813.14
Proportion office and supervision during construction.....	1,756.26
Total cost.....	\$69,811.27

Power Cost Machine-Drill Shift

The costs here presented are chiefly interesting as being authentic and high. A relatively large compressor plant was installed in a southwestern camp to supply air for drills used in the development. The costs cover a typical month of 217 drill shifts. This was about four drills per shift. The compressor could have taken care of 10 to 12 drills with only a slight increase in coal and supply consumption. The fact that it was never run to capacity is the principal explanation of the extremely high direct cost of the air per drill shift.

The depreciation charge against the plant should be more properly called an amortization charge, since it was designed to extinguish the cost of the plant in about two years, long before it would wear out. This, curiously, was just about the time it was used, before the property closed down. The machines used were 2½-in. Sullivan pistons.

COST OF COMPRESSED AIR FOR DRILLING

	Total	Per Drill Shift
Labor—Two men at \$4 per shift.....	\$255	\$1.170
Coal—Dirty mine-run semilignite, costing at bin \$5.65 per ton.....	350	1.610
Lubricants and Supplies—Engine oil cylinder oil, air oil, cup grease, boiler compound, waste and gasoline for lighting.....	60	0.275
Total.....	\$665	\$3.055
Depreciation Charges—4% per month on \$16,584 plant.....	\$663	3.050
Grand total.....	\$1328	\$6.105

The Total Cost of Treating Ore in the Nipissing Low-Grade Mill, calculated on a basis of 7320 tons per month, is \$2.95 a ton, distributed as follows: Labor, \$0.704; supplies, \$1.59; power, \$0.567; workshops, \$0.089. While this cost is somewhat higher than in a concentrating plant, cyanide mill gives an extraction from 92 to 93% as compared with an extraction of approximately 80% in a concentrator.

Top Slicing at Bingham--II

BY D. W. JESSUP*

SYNOPSIS—Details of the systems of timbering adopted in top slicing. Reinforcing, doubling-up, angle and tee sets described. Cheap timber is extensively used.

The timbers used in the system of top slicing practiced in Bingham Cañon, Utah, are framed similar to those used in the square-set system, the latter being a modi-

at right angles to the hanging wall, as it carries a heavier weight. The girt resists the side pressure of the caps.

REINFORCING TIMBER SETS

As fast as the ore is removed the ground is timbered and blocked securely, and as the extraction is continued the pressure of the overburden increases. With the adjustment and settling this pressure may become enormous, and as it is necessary to keep various runways and connections open, the timbers supporting the runways must be reinforced. This is accomplished by doubling-up sets, helping sets, angle bracing, stulls, a tee piece, etc. These are shown in Figs. 6 and 7.

The doubling-up set is a complete set placed inside the weakened timbers, and consists of a cap and two posts. The caps are 6x8 in. and either square or round timbers are used as posts. The helping set is similar to the doubling-up set and is placed outside the failing set of timbers instead of underneath. This set is generally used for strengthening as the weight falls more upon the helping post and less upon the cap, causing a more nearly equal distribution of weight. The cap in the doubling-up set is often crushed and requires an extra post in the center which may block the passage way. The angle brace is used to withstand the lateral pressure. As the stope is opened the hanging wall begins to slack and swell, causing the timbers to ride or move in a horizontal direction and makes the set diamond shaped. This tendency is partially overcome by the angle brace. The brace is cut so that the ends fit snug in the corner formed by the post and cap. When the cap or girt is breaking

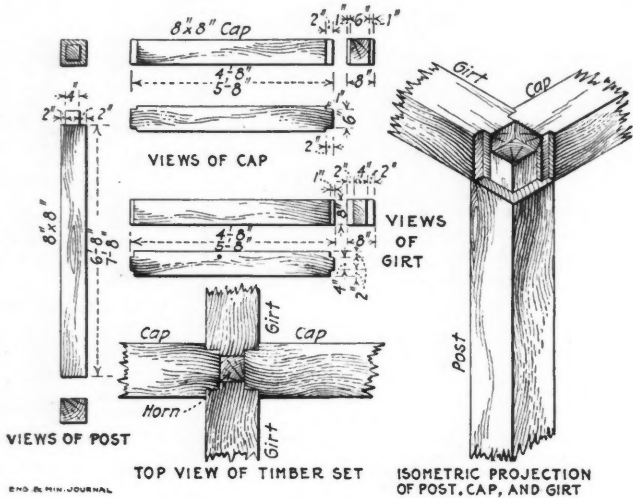


FIG. 5. DETAILS OF SQUARE SET FRAMING

fication of the old Comstock system. The set consists of four posts, two caps and two girts, all 8x8 in., and the necessary lagging, 2x12 in. No sills are laid, the posts setting 4 in. below the bottom of the slice. Either split or whole lagging are used as spreaders being placed

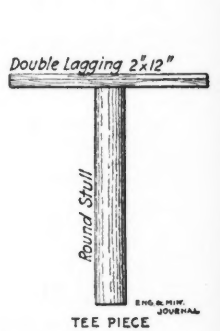
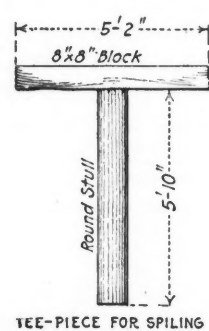
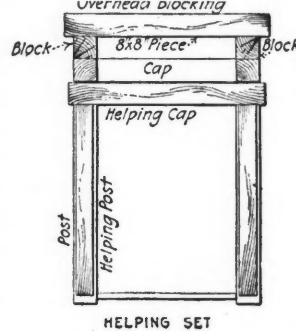
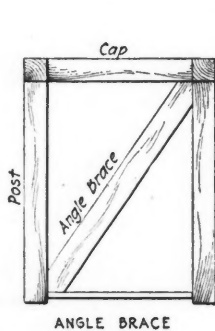
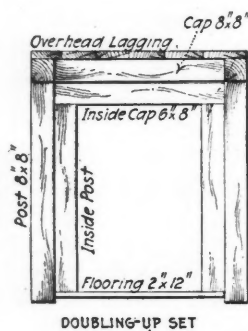


FIG. 7. DETAILS OF BRACING SETS

in between the posts. Lagging or flooring of some nature is laid across the spreaders. Single-horn posts are used, the bottom requiring no horn as it rests on the ground. The posts are either 6 ft. 8 in. or 7 ft. 8 in. long, depending on the pressure of the overburden. This length is measured from the bottom of the post to the top of the horn. The horn is 4x4 in., leaving a bearing surface of 2 in. on each side of the horn for the caps and girts. The caps and girts are either 4 ft. 8 in. or 5 ft. 8 in. in length, according to the nature of the ground. The timbers are assembled together as shown in Fig. 5. The cap is a stronger member than the girt and is placed

FIG. 6. DETAILS OF A TEE SET

under pressure a stull is used for a temporary support, but if it is to remain any length of time the stull will probably buckle and the weight had best be taken up by a helping set. In place of a stull, a tee piece consisting of stull and a block or head board is often used. It is also used to advantage when the lagging from the floor above tends to drop and cause a run or deposition of the overburden. The head board in this case consists of two laggings. Fig. 8 illustrates angle sets used in timbering a heavy hanging wall.

Often there are odd corners, narrow widths and stringers of ore that are mined from one of the floors and may be three or four sets wide. Instead of using the regulation timber set, a combination of tee pieces is some-

*Mining engineer, Salt Lake City, Utah.

times employed and gives good results, especially if that section of the stope is not to remain open for any length of time. The timbers are not placed in any order or system but under the weakest points of the above floor. By this method a great deal of timber and labor is saved.

As each successive slice is mined the overburden becomes more nearly self-supporting and the mat of timbers forms a more compact mass that assists in supporting the overburden and thus causes less weight to fall upon the timbers. This offers the opportunity for use of the tee-piece system of timbering, and in the future one of the large orebodies at Bingham may be mined by this method instead of the slice-set system. But in most of the orebodies it would not be applicable as the overburden is in a fine state and is constantly running down from floor to floor, requiring closely laid flooring and substantial timbering to hold it in check. Also, the heavy pressure of the overburden would be a serious drawback to this method of timbering. The tee-piece system reduces the cost of timber and labor to a large extent, it is used quite extensively in other mining districts with satisfactory results.

POOR-GRADE TIMBER EXTENSIVELY USED

One of the advantages of the top-slice system is that the doubling-up and reinforcing timbers may be of a

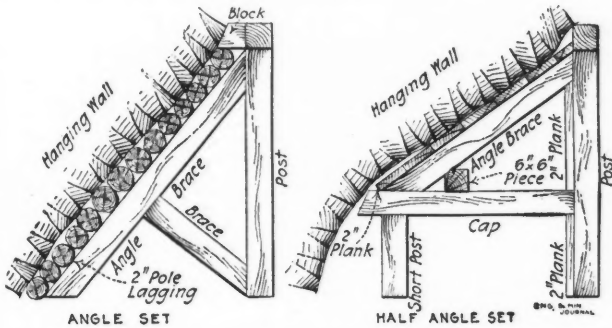


FIG. 8. ANGLE SETS FOR SUPPORTING HANGING WALL

cheap material. They are not permanent, merely being in place for a few days, perhaps weeks, and odd lengths, sizes and nondescript timbers can be used. A large amount of the round timber is quaking asp. It is a cheaper grade than pine or fir, possesses less compressive strength and does not withstand rot as well, but it gives satisfaction. Nothing smaller than a 6-in. end is used and the bark is peeled to prevent rotting. For flooring odds and ends may be used as the purpose is to prevent the overburden from running through into the slice below, though a well laid flooring offers better facilities for shoveling. The top of the slice may or may not need lagging, it depends on the condition of the flooring from the slice above, the latter is usually out of place and is not in position to hold the overburden. The broken timbers in the mat are constantly moving downward and exert a great pressure on the timbers below, causing them to break. These projecting ends are sometimes sawed or cut; if over a post they are blocked against it, but never under any circumstances are they blocked against a cap or girt as the pressure would cause them to break. In blocking the timbers, the wedges are always driven under the bottom and not over the top. When the slice has been finished, a number of unbroken timbers are removed and used again in the following slices.

In some mining districts it is customary to place sills underneath the posts and these sills act as caps for the slice below. This has been found to be unsuitable, it increases the cost of mining to take out the extra ground for the sills. It is difficult to mine the slice below so that the timbers will coincide. It would decrease the height of the slice or cause the posts to be lengthened.

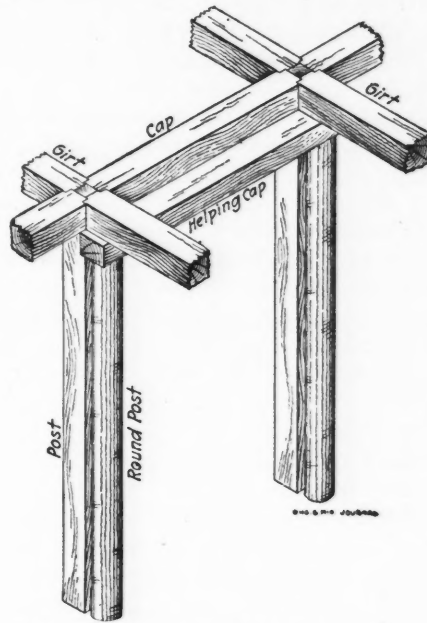


FIG. 9. ISOMETRIC PROJECTION TIMBER SET AND HELPING SET

All of the timbers are framed to dimensions in the company's sawmill. No framing is done underground other than an occasional butt cap or short set. The round timbers are from 10 to 20 ft. long and are cut to the required length by the timberman. The following are the different-sized timbers used in one of the stopes:

- 8x8 in., 39%, for posts, caps and girts;
- 6x8 in., 5%, for doubling-up sets and stringers;
- 2x12 in., 38%, for flooring, side and top lagging;
- round, 18%, for doubling-up posts, stulls and cribs.

(To be Concluded)



Calcium Carbide, Cyanamide and Nitrate

According to a French authority, the world's output of calcium carbide in 1913 exceeded 350,000 metric tons. The autogenous welding of metals requires a large quantity, about 22,000 tons being consumed for that purpose in Germany, as compared with 28,000 tons for illuminating. The price for calcium carbide in Europe was maintained at about £11½ per ton. The production and price are regulated by a syndicate, which at the end of 1913 was renewed for another term.

The production of calcium cyanamide in 1913 was over 150,000 tons. The Odda works in Sweden have a plant capable of making 90,000 tons per annum. All European makers separate the nitrogen from the atmosphere by the fractional distillation of liquid air. The production of calcium nitrate in Europe is between 100,000 and 120,000 metric tons.

A. I. M. E. Banquet and Closing Sessions

Wednesday, the third day of the annual Institute meeting, was given up entirely to simultaneous sessions, covering iron and steel on the one hand and mining law on the other. One of the most interesting discussions of the day was precipitated by Mr. Shamel's paper, "Should the Apex Law be Now Repealed?" Mr. Shamel's attitude was distinctly favorable to the apex law. This was a call to battle for Doctor Raymond and his counterblast was enjoyable and completely demolishing.

The annual dinner was held on Wednesday evening, at the Waldorf-Astoria, where 200 guests enjoyed an excellent dinner. The retiring president gave a short account of the work of the year, and of the increased activities through the formation of the new committees. He expressed his appreciation of the active coöperation of committee members, the enumeration of whose names was the signal for repeated applause, evidencing the general appreciation by the Institute members of the work accomplished during the last year. Mr. Rand then relinquished the chair to W. L. Saunders, who acted as toastmaster for the evening. Mr. Saunders introduced the newly elected president, B. B. Thayer, with a short account of Mr. Thayer's work and rise in Butte, where he said the new president was familiarly referred to as "Big Ben." Mr. Thayer said that this title had now been passed on. It seems that a bear, caught near Butte, had been placed in the public gardens. When E. P. Mathewson wrote Mr. Thayer about the event, he told him that the bear had been named "Big Ben," and suggested that it would be the proper thing for Mr. Thayer to express his appreciation of this compliment by sending the bear a collar. Mr. Thayer replied that he would send the bear a collar provided Mr. Mathewson would agree to attach it to the bear's neck. Up to date, he had not been called upon to supply the collar. After the address of the new president, the toastmaster called in turn upon Thomas B. Stearns, Ex-Sen. T. J. Walsh, Ex-Sen. W. A. Clark, Secretary Emeritus R. W. Raymond, and D. M. Riordan.

Among the most interesting remarks of the evening were the reminiscences of Senator Clark, who told the members of his early experiences in the Rocky Mountains as a miner. He said in part: "My first experience in mining was in 1862, on the Bobtail mine, near Black Hawk, Colo., where I worked on a windlass for some weeks at \$2.50 per day. I then was given a position underground and was inducted into the mysteries of handling a drill, in which I became reasonably expert. This I followed for almost a year, until I decided that there was very little future in a vocation of that kind, and having heard of what they termed the "Grasshopper Mines," then in Idaho in a locality which afterward became part of Montana, I set out in the spring of 1863 for that country with three companions. We purchased two yoke of cattle and a wagon and set out from Denver in May, reaching the town of what was then called 'East Bannack,' in the Grasshopper district, after about 60 days' travel.

"The first night after my arrival we started out on a stampede and secured a claim in a placer gulch, 30 miles from Bannack, which I worked for two years during the mining season. Omitting any reference to my varied experiences in that new country until 1872, in the fall

of which year I first visited the town of Butte, which was then a deserted placer-mining camp, and where there were only about half a dozen people remaining, I will state that my object was to examine the quartz mines, a few of which had been located and abandoned, and there I secured several claims. Believing, however, that I could better qualify myself for proper exploitation of the quartz mines, I came to New York and spent the winter of '72 and '73, where I took a special course in assaying and analysis at the Columbia School of Mines, then established about 44th St. and Madison Ave. Dr. Pierre de Peyster Ricketts, now prominent in the mining world, was then my preceptor. This was the first school of mines established in the United States.

"Previous to this time no one was considered as having any knowledge worth while in mining or metallurgy unless he had taken a course in one of the famous schools of Freiberg or Clausthal, in Germany. The Columbia School of Mines gradually developed into one of the first institutions in the world and graduates from this now famous institution are the leading mining engineers of the United States and may be found in almost every camp. The knowledge that I gained in the School of Mines was of great service to me afterward in my career of developing and operating mines. In recent years other schools of mines have been established in various parts of the United States, which have given a great stimulus to the mining industry.

"I have long been a member of the Institute of Mining Engineers and I bear tribute to the great and valuable work that this institute has accomplished. The discussions of great problems in mining and metallurgy and the papers which have been read at the various meetings of the Institute have had a widespread and valuable influence.

"I observe present this evening one of the founders of the Institute, who for a long period was editor of the ENGINEERING AND MINING JOURNAL. His contributions to this journal have given it a high standard in the mining world, and the fact that hundreds of millions of pounds of copper are sold annually based on the quotations of the average price of copper as published in its columns indicates the confidence which both sellers and buyers repose in the management of that journal."

Thursday morning the geologists foregathered in one of the assembly rooms and the oil and gas people in another. The geologists finished by noon, but the oil and gas section held two sessions. In the afternoon some miscellaneous papers were read, chiefly by title, in the smaller assembly room, while the oil and gas session was in progress.

The questions proposed for discussion in the geological session were the depth of the standing groundwaters, the primary or secondary nature of chalcocite and the origin of contact garnet zones. L. C. Graton opened the discussion on chalcocite by stating that contrary to the usual experience of geologists in such cases, he had found that his investigation into the origin of chalcocite was one which even old, hard-headed, practical miners welcomed as being really of some use. Those present had a chance to see the results of H. V. Winchell's now almost historical experiment on the precipitation of chalcocite by pyrite with and without the presence of SO₂. Waldemar Lindgren called attention to the beautiful specimens of chalcocite found in the Bristol mine in Connecticut, now al-

most forgotten, but at one time America's greatest copper producer.

Professor Lindgren then read the first paper on garnet zones. He was, as he said, frankly partisan and combative. He divided the students of contact phenomena into three schools: That which held with himself, Kemp and Spurr, that the magma supplied most of the constituents of the contact minerals; that which held with Leith, that the sedimentaries supplied most of these constituents; and that of Lawson, who would not admit a magmatic origin for any deposit if he could possibly get out of it. Dismissing Lawson as of little importance, he centered his attack on the theories and arguments of Leith. C. K. Leith's paper was read by James F. Kemp. He began his exposition by stating that he would attempt to write in a noncontroversial spirit, whereupon everybody laughed at Professor Lindgren, who certainly had not so written. To the amateur listener, Leith's paper sounded much like a partial surrender; its principal argument was largely quantitative and mathematical. Lindgren, in discussing this paper, stated his belief that geologists could not be too careful how they associated with mathematicians. Everybody laughed again and went to lunch.

A long list of oil and gas papers were read by title or in abstract. Perhaps the most interesting were those of Eugene Coste, Professor von Hofer, and I. N. Knapp. The last also gave an illustrated address on oil and gas sands, showing photomicrographs of these sands and numerous field views. Mr. Coste, who is a zealous advocate of the inorganic theory of the origin of petroleum, summarized his own paper on this subject, and discussed Professor von Hofer's paper, which contended for organic origin. Time was lacking for oral discussion of this important but perennial question. Before the session was adjourned by President Thayer, a communication was read from Doctor Douglas, suggesting that the Institute library be made of more practical use to members in the field by monthly bulletins reviewing new acquisitions to the library, and by translations and abstracts at a nominal price, when desired; coöperation in this matter with the other affiliated engineering societies was suggested. The meeting adjourned to reconvene on Aug. 10, 1914, at Salt Lake City, under the auspices of the precious- and base-metals committee.

One of the most interesting events in the four days' meeting, was the demonstration by a high-class imported dowser, who, at about 2:30 Thursday afternoon, in the presence of a small, but intensely interested audience, traced some electric cables under the floor of the corridor, outside of the assembly rooms. Almost everybody was in attendance at one or the other of the technical sessions, and was therefore unaware of the dowsing experiment; otherwise, that little sideshow would probably have depopulated the main tents.

The following is the program, excluding the iron and steel, and petroleum and gas papers.

PROGRAM OF TECHNICAL SESSIONS

TUESDAY, FEB. 17, 10:30 A.M.

"Mining and Mining Methods in the Southeastern Missouri Disseminated-Lead District," by H. A. Guess.

"The Mill and Metallurgical Practice of the Nipissing Mining Co., Ltd., Cobalt, Ontario," by James Johnston.

"The Disposition of Natural Resources," by George Otis Smith.

2 P.M.

"Use of Electricity at the Penn and Republic Iron Mines, Michigan," by Wm. Kelly and F. H. Armstrong.

"The Application of Electric Motors to Shovels," by H. W. Rogers.

"Remarks on Electric Traction in Mines," by Charles Le Grand.

"Safeguarding the Use of Electricity in Mines," by H. H. Clark.

"The Safety of Underground Electrical Installations," by C. M. Means.

"The Injection of Cement Grout into Water-Bearing Fissures," by Francis Donaldson.

"Drilling Performances at the Kensico Dam, Catskill Aqueduct System, New York," by W. L. Saunders.

"The Work of Crushing," by Arthur F. Taggart.

PAPERS ON MINING LAW

"Why the Mining Laws Should Be Revised," by Horace V. Winchell.

"Comparison of Mining Conditions Today with Those of 1872 in Their Relation to Federal Mineral Land Laws," by R. W. Raymond.

"Objections to the Apex Law in Mining Practice," by C. F. Kelley.

"Should the Apex Law Be Now Repealed?" by C. H. Shamel.

"The Apex Law in the Drumlummon Controversy," by C. W. Goodale.

"The Classification of Public Lands," by George Otis Smith.

PAPERS ON MINING LAW

"The Segregation and Classification of the Natural Resources of the Public Domain," by F. F. Sharpless.

"The Initiation of Title to Mineral Lands," by Albert Burch.

"Good Ideas in the Mining Laws of British Columbia and Mexico," by F. L. Sizer.

"Provisions for Judicial Review of Land Office Decisions," by M. D. Leehey.

"The Apex Law Illustrated by Decisions in the Cœur d'Alene," by F. T. Greene.

"Uniform Mining Legislation in all States Based on Federal Acts," by E. O. Holter.

"Uniform Mining Legislation in all States Based on Federal Acts," by C. L. Colburn.

"Location of Mining Claims Upon Indian Reservations," by Will L. Clark.

"What Is Mineral Land?" by Grafton Mason.

"Mining Law Revision—How to Obtain It," by E. B. Kirby.

4:30 P.M.

Illustrated Paper on Mining of Bituminous Coal," by Samuel A. Taylor.

THURSDAY, FEB. 19, 10 A.M.—PAPERS ON MINING GEOLOGY

(Simultaneous Sessions in Different Rooms)

Discussions on the questions:

1. "To What Depth Below the Surface Do the Standard Groundwaters Extend?" Opened with a paper by Alfred C. Lane.

2. "To What Extent Is Chalcocite a Primary, and to What Extent a Secondary, Mineral in Ore Deposits?"

(3) "To What Extent Are the Contact Zones, Often Called Garnet Zones, Produced by Intrusive Rocks from Limestone Walls, Due to Recrystallization of Matter Original with the Limestones; and to What Extent Are They and Their Associated Ores Due to Contributions from Intrusive Rocks?" Opened with papers by Waldemar Lindgren and C. K. Leith.

MISCELLANEOUS

"The Equilibrium Diagram of the System $Cu_2S-Ni_3S_2$," by Carl R. Hayward.

"Cyanidation of Silver Sulphides," by Robert Linton.

"The Genesis of the Mercury Deposits of the Pacific Coast," by J. A. Veatch.

"Ore Dressing at the Morning Mill, Mullan, Idaho," by Rush J. White.

"A Proposed New Converter, and the Application of the Bessemerizing Process to the Smelting of Ores," by Herbert Haas.

"Milling versus Hand-Sorting of Lead Ore," by R. S. Handy.

"Nickel Deposits in the Urals," by H. W. Turner.

"The Burning of Coal Beds in Place," by Alex. Bowie.

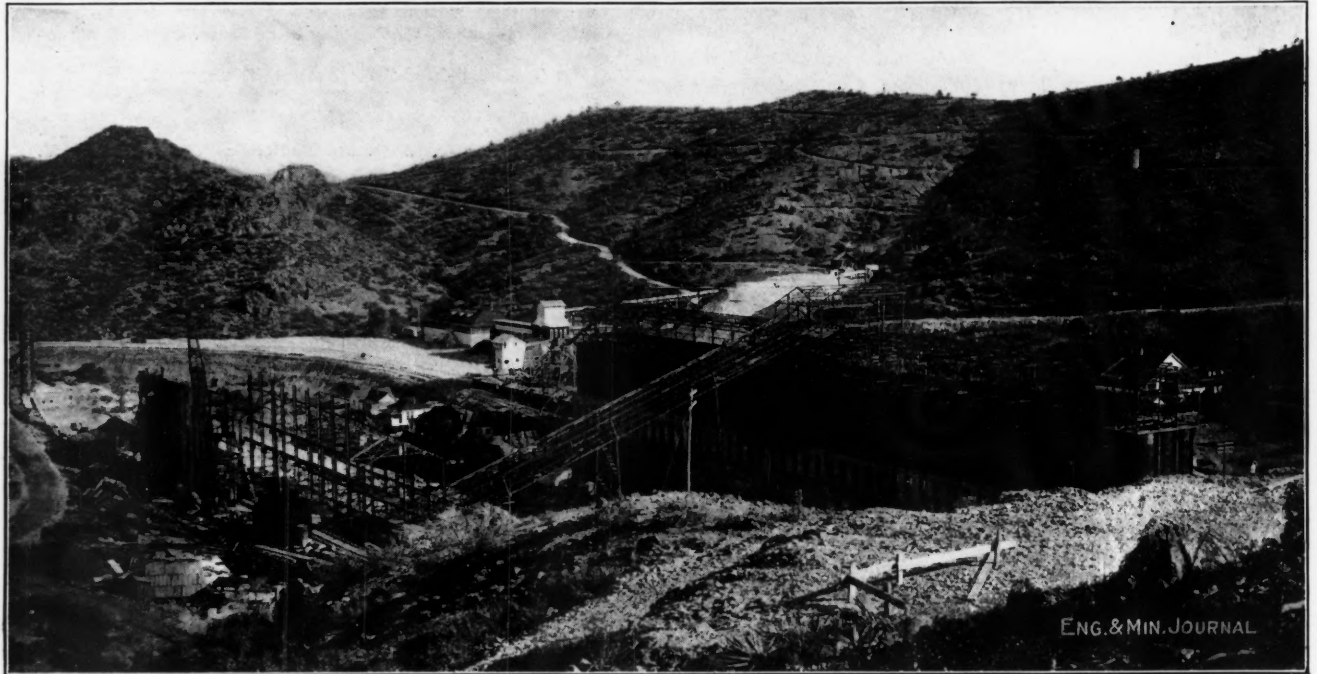
"The Use of Oxygen Helmets in Mine Fires," by E. P. Dudley.

"Geology and Ore Deposits of the Bully Hill Mining District, Cal.," by A. C. Boyle, Jr.

4 P.M.

Illustrated address on "Oil and Gas Sands," by I. N. Knapp.

Photographs from the Field



INSPIRATION CONSOLIDATED STORAGE BINS OF 25,000 TONS CAPACITY AT MIAMI, ARIZ.

To left, site of two main shafts. Larger portion of structure which will be the crushing plant, has been erected. In background, dormitory, mess house and temporary crushing plant supplying ore to test plant now operating.



INSPIRATION CONSOLIDATED 8000-TON MILL NOW BEING BUILT

In foreground, test plant, at present treating 740 tons per 24 hr. In far background, to left, site for International Smelting & Refining Co.'s new smelter. Building partially erected in right background, machine shop and warehouse.



ENG. & MIN. JOURNAL

SAKURAJIMA FROM THE CITY OF KAGOSHIMA, KYUSHU, JAPAN

The recent eruption of this volcano caused the loss of many lives and affected the district in which the Yamagano gold mine is situated, the operators of which have supplied this photograph taken at 11 a.m., Feb. 12, one hour after the first explosion.

The Buckhorn Mill

The Buckhorn mill, at Buckhorn, Eureka County, Nevada, has recently begun operations. This is known as a "Wingfield company," as it is said to be controlled by the same people who control Goldfield Consolidated and allied interests.

The plant consists of a 20x10-in. Blake crusher fed by a shaking screen from a 30x20-ft. steel ore bin; a 32-in.x10-ft. washing screen; 40x15-in. Gates Anaconda-type rolls; 6-ft.x16-in. Hardinge conical mill; two 12-in. bucket elevators; two 45-in.x15-ft. Akins classifiers and two 5x18-ft. Allis-Chalmers chain-driven tube mills with Komata liners.

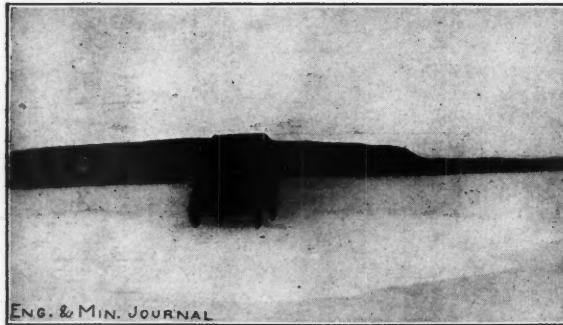
The cyanide plant consists of three 32x15-ft. Dorr agitators connected for continuous agitation, followed by six 35½x12-ft. Dorr thickeners, and arranged for a change of solution between the first and second set of three thickeners. Decanted solutions are classified in three 35x60-in. Perrin presses and precipitated with zinc dust, using two 52x30-in. Merrill precipitate presses. The thickened slime is filtered in four 14-ft. Oliver filters with 12-ft. face.

Precipitate is briquetted with litharge, borax and soda and melted in a 20-in. blast furnace, and the lead bullion cupeled in a 54x40-in. oil-fired cupeling furnace. The bullion is remelted in a No. 60 Donaldson tilting furnace.

the future a rate no higher than \$10 per ton shall be applied to the Phoenix zone. Such rate may be blanketed to all points in the state of Arizona or in the alternative it may be increased 25c. per ton per zone for each zone east of the Phoenix zone, provided there be a like decrease west. The rates so made shall apply from all of the California producing points within the area designated herein, so long as the present grouping system shall be maintained.

New American Potash Works

The new experimental unit in which the American Trona Corporation will begin the manufacture of potassium chloride and other salts from the brine of Searles Lake, Calif., is now nearing completion, and is expected to be ready for operation in from 30 to 60 days. The 31-mile railroad from Searles on the Nevada & California R.R. (Southern Pacific) is nearly completed to the new town of Trona, where the new works are being built. The preliminary plant will handle about 20,000 gal. of brine daily, and when the process and equipment have been thoroughly proved by actual operation, the works will be enlarged. The most important salts contained in the Searles Lake brine are potassium chloride, borax and soda ash. A typical analysis of the brine is as follows: Borax, 2.93%; soda ash, 4.92%; common salt,



TRAVELING OVER THE CRYSTAL BODY IN AN AUTOMOBILE



ROAD THROUGH THE "MUD" AT THE NORTH END OF SEARLES LAKE

Power for the mill and motors and electric haulage is generated at the company's power plant at Beowawe, Nev., already described in the JOURNAL, Dec. 27, 1913.

Rates on Fuel Oil to Arizona

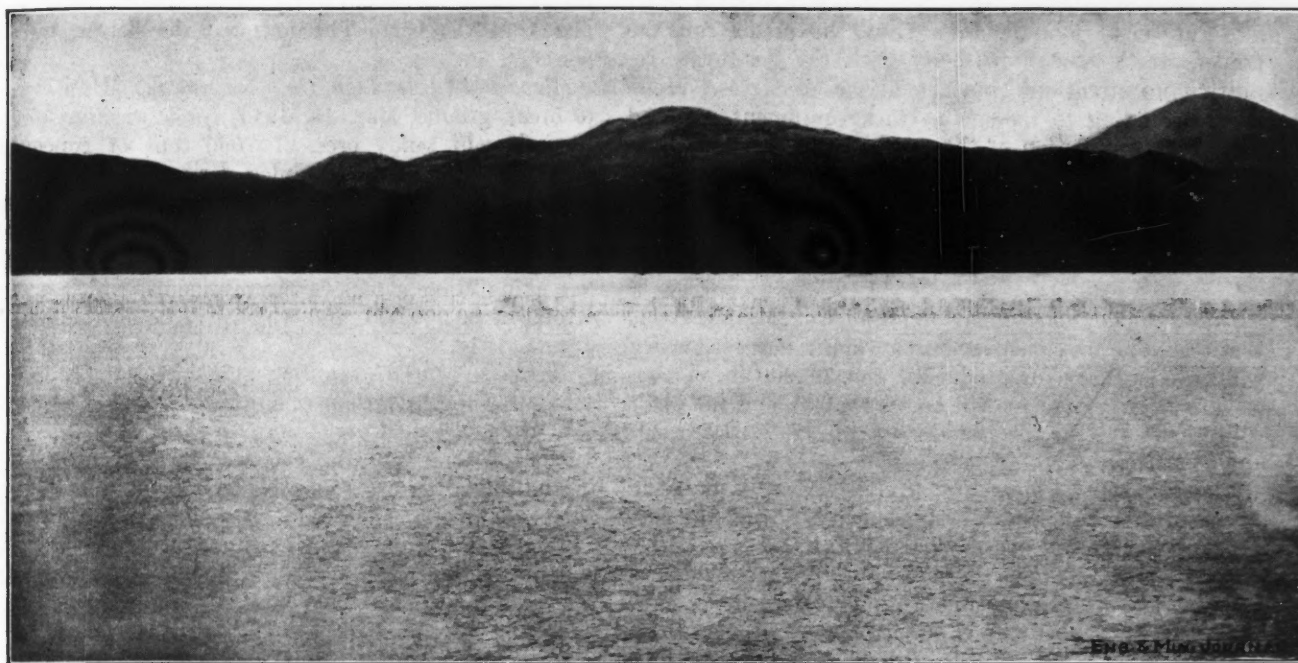
WASHINGTON CORRESPONDENCE

The Interstate Commerce Commission has handed down a decision in regard to the rates on fuel oil, refined petroleum and engine distillate from producing points in California, Kansas, Louisiana and Texas to all points in Arizona, which are found unjust and unreasonable. After a review of the existing rates and a comparison with those which prevail from the Texas field to northern and eastern points in terms of charge per ton the commission says that the rate on petroleum and its products from the California producing points to Phoenix, an average distance of 535 miles, is \$19. This rate is characteristic of the rates from the California producing points to all points in Arizona. From a consideration of all the facts disclosed by the records it is our conclusion that such a rate is unreasonably high and in

15.84%; sodium sulphate, 6.72%; potassium chloride, 4.36%; a total of 34.77% of total solids.

The ownership of the deposits still remains with the California Trona Co., and the railroad is being built by the Trona Ry. Co. The American Trona corporation will confine its operations to manufacturing. The directors are Baron Alfred von der Ropp, H. H. Webb, Guy Wilkinson, James McDougall, J. A. Brown, A. C. Harrigan, and Edward E. Arnold. The products will be marketed through the firm of Arnold, Hoffman & Co., of Providence and New York. It is not expected that the salts from the Searles Lake deposit will enter the market regularly until the latter part of this year.

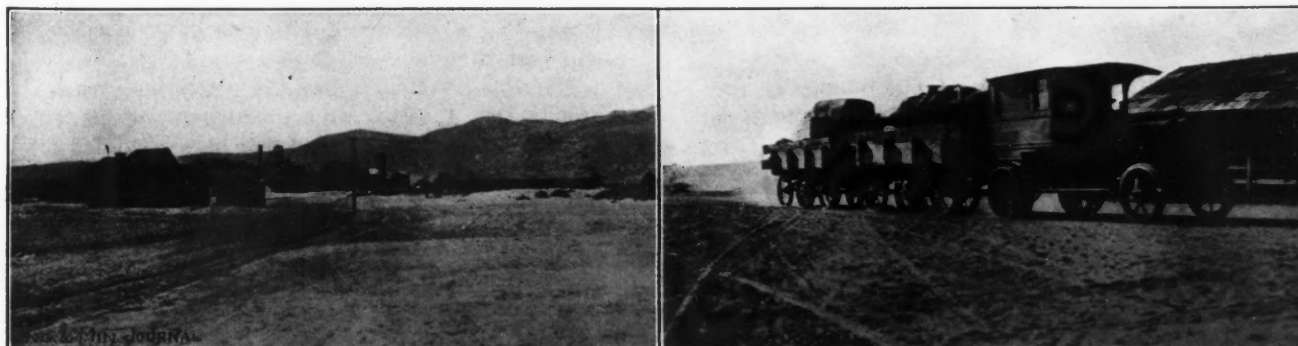
The accompanying views give a good idea of Searles Lake, the old works of the California Trona Co., and a Renard motor-truck train used for hauling supplies. The exposed crystal body of Searles Lake comprises an area of about 12 square miles. This is surrounded by an annular mud ring which is more or less white at the surface, depending upon the amount of efflorescence. The Renard motor truck shown in an accompanying engraving has hauled as many as six and often four trailers.



SEARLES LAKE, CALIFORNIA, LOOKING WEST ON THE EXPOSED CRYSTAL BODY WHICH COVERS ABOUT 12 SQUARE MILES



IN THE FOREGROUND IS SHOWN A PART OF THE ANNULAR MUD RING SURROUNDING THE EXPOSED CRYSTAL BODY OF SEARLES LAKE



THE OLD WORKS OF THE CALIFORNIA TRONA COMPANY

RENARD TRAIN USED IN CONVEYING SUPPLIES ACROSS THE DESERT

Each trail car drives itself, taking power from a shaft with universal joints, driven from the motor car, the trailers track almost perfectly with the head car, requiring no attention from the driver at curves. However, in adding to the motor-truck equipment required before the completion of the railroad, the company purchased additional trucks of an American make.

New Mine and Metallurgical Construction

International Smelting & Refining Co., Miami, Ariz., broke ground in December for a copper smelter, which will have capacity for producing 100,000,000 lb. of copper annually. The cost will be \$2,000,000, and the plant will consist of four reverberatory furnaces, blast furnace and converters.

Kelvin-Sultana Copper Co., Kelvin, Ariz., is building a concentrator of 100 tons daily capacity, to cost \$50,000, and to be completed about June 1, 1914.

Twin Peaks Mining & Milling Co., York, Ariz., is building a concentrator and cyanide plant of 50 tons daily capacity; scheduled to be completed Mar. 1, 1914.

Bishop Creek Milling Co., Bishop, Calif., will break ground Apr. 1 for a \$25,000, 10-stamp mill and cyanide plant of 50 tons daily capacity, and which will be completed by July 1, 1914.

Brunswick Consolidated Gold Mining Co., Grass Valley, Calif., is planning to build a mill of 50 tons daily capacity at a cost of \$20,000.

California Exploration Co., Ltd., Plymouth, Calif., will build an amalgamation and concentration mill of 300 tons daily capacity, to cost \$78,000. It is expected that ground will be broken at the end of February and the plant will be completed some time in June, 1914.

Excelsior Gold Mines Co., Forest Hill, Calif., is building a stamp mill of 200 tons daily capacity.

Keane Wonder Mining Co., Keane Wonder, Calif., broke ground in December for a crushing (three sets of rolls) and cyaniding plant of from 300 to 500 tons daily capacity; estimated cost \$50,000 and scheduled date of completion, June 1, 1914.

Midas Gold Mining Co., Knob, Shasta County, Calif., is building an all-sliming cyanide plant for stored and current tailings, of 100 tons daily capacity, at a cost of \$30,000. Ground was broken in June, 1913, and the plant will be completed in December, 1914.

Mountain Copper Co., Keswick, Calif., is building a flotation concentrator for copper ore of 250 tons daily capacity.

R. P. Newcomb, Oat Hill, mine, Middletown, Calif., has just completed a concentration plant for cinnabar ore.

El Oro Mining & Milling Co., Elkton, Colo., is building a combination milling plant of 300 tons daily capacity, which will cost \$100,000.

Mountain Top Mining Co., Ouray, Colo., expects to build a mill next season.

Vindicator Consolidated Gold Mining Co., Independence, Colo., broke ground Dec. 1, 1913, for a screening plant of 200 tons daily capacity, which will cost \$20,000, and which, it is expected, will be completed July 1, 1914.

Virginia Consolidated Gold Mining Co., Sandy Creek, Lemhi County, Idaho, will break ground in May for an amalgamation and concentration mill of 20 tons daily capacity,

to cost \$25,000, which, it is expected, will be completed in October. The mill will be driven by water power.

Cleveland-Cliffs Iron Co., Nashwauk, Minn., expects to break ground Mar. 15, 1914, for a washing plant to treat Mesabi sandy ores, of 2000 tons of concentrates daily capacity. It is scheduled for completion July 15.

Anaconda Copper Mining Co., Butte, Mont., is building a 2000-ton leaching plant at the Washoe works, which is later to be increased to 9000 tons daily capacity, and is making other extensive improvements, which will cost a total of \$6,000,000, and which will be completed about Jan. 1, 1916.

Butte-Duluth Mining Co., Butte, Mont., is building a mill for treating 1000 tons of ore per day, which will cost \$130,000.

King & Queen Mining Co., Keystone, Mont., is building a lead-silver ore concentrator of 125 tons daily capacity, at an estimated cost of \$20,000.

Timber Butte Milling Co., Butte, Mont., is building a zinc-ore concentrator of 350 to 400 tons daily capacity, at a cost of \$600,000; which, it is expected, will be completed by May 1, 1914.

Carrara Mining & Milling Leasing Syndicate, Carrara, Nev., broke ground Dec. 20, 1913, for a \$5000 mill, containing three 15-ton Chilean mills, scheduled to be completed Feb. 20, 1914.

Commercial Mines & Milling Co. of Manhattan, Manhattan, Nev., is making an addition to the old mill, to bring it up to a capacity of 200 tons per day; it was expected that the work would be completed Feb. 15.

Eastern Star Mining Co., Midas, Nev., plans a stamp mill.

Tomboy Mine, Battle Mountain, Nev.; work will probably be started this summer on a mill of 50 tons daily capacity.

Wagner Azurite Copper Co., Luning, Nev., has completed a 100-ton leaching plant for copper ore, the first of several units, which will be built later if the first gives satisfaction.

International Smelting & Refining Co., Perth Amboy, N. J., is enlarging Raritan refinery from 35,000,000 to 40,000,000 lb. monthly capacity.

Church-Mabon Mining Co., Miami, Okla., is building a lead and zinc mill of 200 tons daily capacity and which will cost \$25,000. Ground was broken Dec. 1, 1913, and mill will be completed Mar. 1, 1914.

Aluminum Co. of America, Maryville, Tenn., broke ground for a new reduction plant July 1, 1913, which was scheduled for completion on Feb. 1, 1914.

Chewelah Copper King Mining Co., Chewelah, Wash., is building a smelter of 100 tons daily capacity, which will cost \$50,000.

Metaline Oriole Mining Co., Metaline, Wash., broke ground Oct. 1, 1913, for a concentrator of 50 tons daily capacity, to cost \$5000, and which is scheduled for completion June 1, 1914.

Western Wyoming Mining & Milling Co., Cokeville, Wyo., expects to break ground May 1, for a 50 to 75 tons daily capacity treatment plant, to cost \$20,000, and which, it is expected, will be completed by July.

Mt. Morgan Gold Mining Co., Mt. Morgan, Queensland, Australia, is building a concentrator and smelter of 400,000 tons annual capacity, shops and power plant, at a cost of \$1,600,000.

Editorials

Claims Accruing against Mexico

In the discussion of the Mexican situation it has been argued by some of the newspapers that Americans who put their money into investments in that country took their chances and should not complain because fate has been adverse to them. There might be some plausibility in this argument as to American investments in Turkey or China, but as to Mexico it is wholly fallacious, as every well informed person knows. American investment was not only invited but was courted by the Mexican government. Apropos of this it is interesting to be reminded of the words of Secretary Bayard in 1888, when protesting against certain cases of ill treatment of Americans. He said:

Mexico, in pursuance of a policy of wise development of her material interests, has, by numerous legislative acts and executive decrees, invited foreign capitalists, engineers, miners, and business men of skill and enterprise to unite in bringing into the market the great wealth, mineral as well as agricultural, which remains as yet unutilized in her territory. . . . It is evidently a matter of the utmost importance to Mexico that the immigrants to be attracted within her borders shall be industrious, thrifty, and law-abiding citizens, and it is no less evident that such persons will not risk their persons or their property where they cannot feel assured that at least some reasonable effort will be made by the authorities to extend to them the protection of the law.

The claims now on file in the Department of State aggregate a large sum, we understand. Some of them are, no doubt, exaggerated, but to a large extent they are true. The day of reckoning will come some time.

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On Mine Salting

The public spirit of J. W. Ledoux, in exposing a salting job, of which he was the victim, as he did in a recent issue of the JOURNAL, deserves high praise. Many engineers at one time or another have been so tricked, but few ever mention it. At the most they may apologetically tell of it in after years as something that happened in their younger days, when they were green hands. Few tell about it promptly, when exposure may do some good.

Now there is nothing disgraceful in an engineer's being salted in so far as he is concerned. The disgrace belongs to the man who commits the crime. Nor is the engineer justly open to criticism unless he has been grossly careless or has displayed bucolic guileness, neither of which can generally be charged to an experienced engineer.

No matter how careful be the precautions to safeguard his samples that the engineer may take, the villainous will find ways to tamper with them if they be clever enough. There is far less of this now than there used to be, for the reason that the engineer has developed systems of check samples, and other methods, that act as tell-tales; and there is no particular use in anybody salting a lot of samples if the trick is going to be discovered promptly. In many of our mines of nowadays, moreover,

such as the porphyry copper mines, the sampling is so extensive an undertaking, running so long and employing so many men, that a salting system almost beyond conception would have to be devised in order to be successfully carried through. On the other hand, the drill sampling of gold dredging ground is singularly difficult to safeguard and if there be united with that a wide-reaching system, possible under certain conditions as it appears, the combination is well-nigh irresistible.

✽

Once More the Mining Census

The Washington correspondent of the Boston *Transcript* has just reported an "inside story of the suppression by the Census Bureau of vitally important mining statistics." In brief, the charge is that these figures have been suppressed for the reason that they would show the cost of production, wages, profits and losses, etc., in ways that would be awkward to the administration with respect to the pending labor disputes, trust investigations, etc., and the administration's policy thereto.

Our opinion is that this is wholly a cock-and-bull story. We have no sympathy with Brother Wilson's attitude in the Michigan strike and should be delighted to see authoritative statistics brought out that would upset him in that and would throw light on all controversial matters, but we do not think that such statistics are going to come out of the Census Bureau. We do not believe the Census has got them. As we have remarked several times previously the last mining census was a great fiasco. It was such because of the incompetence of the officials who had charge of it. Dr. Isaac A. Hourwich, the "expert special agent on mining," who was at the head of this work, is not well versed in mining and metallurgy. Since leaving the Census he has been secretary of the Cloak-makers' Union in New York. If the next mining census be put in the hands of genuine experts there may be some useful results.

✽

The Income Tax

Governmental methods in business affairs have been exemplified in the income-tax measure which goes into effect next week. For a long time previous it had been a leading topic of discussion, not by reason of its fairness or unfairness, but because no one knew just how to comply with the law and the rulings of the collectors. The law distinctly has teeth. The person who tries to dodge his tax is liable to severe fine or may be imprisoned. Yet the terms of the law are so uncertain and its phraseology so imperfect that even the most erudite lawyers are at sea respecting some of its provisions, and indeed the law has had to be amplified and defined by a long series of Treasury rulings. But this is not all. The Treasury has reversed itself on some of these rulings, thus adding to the muddle.

Some of the Treasury rulings have been manifestly absurd. Complying with certain of them the tax-payer is

obliged to make a false return and swear falsely; or else he must disregard the ruling in order to swear truly.

In many of these Treasury rulings there has been, of course, a usurpation of the right to legislate, an exercise of unconstitutional authority. We shall consequently see litigation upon this point, resulting from the refusal of some persons to recognize the Treasury rules and acceptance only of the terms of the law which the courts must interpret. Also, the constitutionality of the law itself will be attacked upon the ground that it is class legislation.

✽

Danger Signs Underground

It is well recognized that the lack of a universal language is a common source of underground accidents. It is exceedingly difficult to teach safety precautions to a non-English-speaking foreigner or to give instructions in specific cases so clearly that they may not be misunderstood. And ignorance of general rules, together with specific acts, based on a misunderstanding of oral instructions, are powerful factors tending to run up the accident and death rates in our mines. This is more and more the case as the percentage of foreigners employed underground increases, which is an unquestionable a tendency at present in the industry. Most companies attempt to meet the difficulty by printing rules in several languages, covering the more important groups of workmen. Where a force includes representatives of 20 or 30 nations speaking distinct languages, however, this device cannot be wholly successful.

To avoid this difficulty in one particular at least the Beaver Consolidated, at Cobalt, reverts to the universal sign language. Where a missed hole is known or suspected in a drift, a red flag is placed at the drift entrance and all the men, from whatever nation, who see the flag, know at once that there is danger in that drift and that they must be on their guard.

Intelligent initiative like this is only what might be expected from the Beaver, operating as it does under probably the most advanced and effective inspection system in the world.

✽

Affairs in Mexico

The destruction of a railway tunnel in Mexico, recently, and the engulfment of a train loaded with many passengers, brought a new bandit into the public eye. Villa has pretty well swept the north of Mexico and Carranza has taken some steps toward establishing a form of Government. Railway lines were being rehabilitated and mining and smelting companies were considering resuming operations. Then appears Señor Maximo Castillo, professing hostility to both Huerta and Villa, who begins to cut up and has to be chased. If Villa should drive out Huerta, some Castillo may drive out Villa, and then he may be driven out by some Don Fulano.

While this procession of rulers might be amusing as a comic-opera incident, to us it has as sinister an aspect as did Maebeth's line of spectral kings. Can order ever be restored by any Mexican "man on horseback," or will it require the offices of an army from north of the Rio Grande, or what would be equally or more repugnant,

an international column, such as entered China. And if intervention must come, how much longer shall we permit the Mexicans to learn the art of war. And how thoroughly shall we equip the various bandit forces before beginning operations. This may be the height of chivalry—it's the height of something, we feel assured.

✽

An Exportation of Lead

A few weeks ago a noteworthy event, which we could not report at that time without betraying confidence, transpired in the American lead market, viz., the exportation of domestic lead from Missouri to Europe. Of course, lead imported from Mexico and elsewhere and smelted and refined here in bond is being exported all the time, but if our recollection be correct no domestic lead, sold in Europe because it realized a better price than here, has been exported since lead was shipped out from Eureka, Nev., in the '70s. Back in the '50s, there were large exports of lead from Wisconsin, and that in spite of the long and costly transportation of the product by wagon over corduroyed roads. However, the Wisconsin lead ore of that day was of high grade, and that is what tells the story in cost of production. Most of our lead of the present time comes from ore that is low in grade.

The recent shipment to Europe was made at a time when lead at London was about 4.35c. per lb., at New York 4.15c., and at St. Louis about 4.05c. The London-New York differential did not permit profitable sales from here, but a freight rate of 22c. per 100 lb. from St. Louis let it go from there.

The subsequent decline in the price at London checked this business, which was interesting in showing how nearly the European and American markets are in balance, a condition which has indeed existed for many months, although we have not previously given lead to Europe. However, the European market has been for a long time a bolster to our own, which, of course, our producers will forget about at some time in the future when the balance may swing the other way and our lower tariff may permit Europe to send us some lead.

✽

The Hall Process

The Hall process of desulphurizing ores, of which so much is expected, is requiring time to develop, which is of course the experience with most new processes. Few spring fully grown into the field of science and the arts. The Hall process is being tried at the works of the Balaklala Consolidated Copper Co., at Coram, Calif., and pending determinations there it is improbable that anything very elaborate will be tried elsewhere.

The process has been tried at Coram in several runs, but these have so far been short in each case. However, it is considered that they have been encouraging in their indications, the troubles having been chiefly mechanical, as is apt to be the case. Anyway, nothing unexpected has appeared. The sulphur that has been obtained from the furnace is said to be clean and pure.

✽

Reports from the mines indicate that there is a superfluity of young *engineers* seeking employment, but a chronic scarcity of scientific *foremen*.

BY THE WAY

Have you filed form 1040 yet?

✂

From the advertising columns of a New York daily:

WANTED—\$500 to float the stock of company incorporated under laws of N. Y. State. Only security \$2000 par value in stock, which will be worth par if flotation succeeds, or nothing if it does not. A sound proposition, if you don't mind taking a chance.

A good sporting proposition, but perhaps not so for the persons among whom the stock, that may be worth nothing at all, is to be floated.

✂

Professor Jenks is a learned gentleman, but, says the *Iron Trade Review*, is hardly able to qualify as an expert on trade journalism. His statement at the hearing in the Steel Corporation dissolution suit, that trade paper quotations "do not represent the actual buying and selling prices, but simply the general trend of prices, and more frequently, perhaps, the general asking price of some of the leading sellers," shows that even a learned professor will talk sometimes about things concerning which he has very little knowledge.

✂

Observations of a new geological phenomenon is reported from Girard, Kan. The water of the wells of the town rose to the temperature of 120° F. C. A. Haskins, the state engineer, has examined them, but is not able to offer any explanation. The mystery remains unsolved. Not even has it yet been ascribed to radium. According to press dispatches, Girard officials have received hundreds of letters from all parts of the United States, asking about the water. One letter concluded: "Kansas people are awful liars." This may be as good an explanation as any.

✂

The Alaska railway bill has passed the House. Some of the representatives professed discernment. Thus, Mr. Madden, of Illinois, who later voted against the bill when it came to final passage, told the House that he believed the Guggenheims wanted to unload a white elephant on the Federal Government through the assumption by the Government of their present Alaskan lines. Said Mr. Madden: "I have long suspected that the Guggenheims had a hand in this bill, and this afternoon I am more sure of it than ever." We wonder if there be anything in this idea, which, by the way, is not a new one.

✂

In days of booming prices, says the London *Financial News*, it is worth while to bear in mind that our forefathers saw much bigger booms than we are likely to do. The mining boom of 1824 and 1825 achieved a scale of magnitude beyond anything in modern experience. Here, for instance, are the prices of five selected shares on Dec. 10, 1824, and on January 11, 1825:

	Dec. 10	Jan. 11
Anglo-Mexican (£10 paid).....	£43	£158
Brazilian (£10)	10s. dis.	66
Colombian (£10)	£29	82
Real del Monte (£70)	550	1350
United Mexican (£10)	35	1550

For the City's own sake, perhaps, it is as well that this kind of thing should not be repeated.

It might be well to note the progress made at Washington in bringing about better civic conditions in Mexico, says Thompson, Towle & Co.'s "News Letter."

- July 20 Better conditions predicted.
- Aug. 1 Probably will begin to improve tomorrow.
- Aug. 9 Will soon begin to look brighter.
- Sept. 1 Huerta on his last legs.
- Sept. 8 Huerta still on his last legs.
- Sept. 18 Huerta has no money.
- Sept. 25 Still no money. A change predicted for tomorrow.
- Oct. 1 Huerta defiant, but again on his last legs.
- Nov. 8 Huerta has fled.
- Nov. 9 Huerta has returned. Did not flee.
- Nov. 28 Mexican banks about to close.
- Nov. 30 Huerta still on last legs—the very last.
- Dec. 16 Things about to change.
- Dec. 30. Huerta flees again but returns again. No fleas.
- Jan. 8 Again last legs.
- Jan. 26 Last legs.
- Jan. 27 L. I.
- Feb. 4 L. I. but going to increase army.
- Feb. 10 Again last legs.

✂

At a dinner of the Massachusetts Reform Club, on Feb. 20, Doctor Eliot, President Emeritus of Harvard, declared that "labor unionism is the most formidable danger in our future." "It is a moral danger," he continued, "as well as material. The unions just rot a man's character and no one can escape their influence. The tendency is to work day after day with the deliberate purpose of doing as little labor as possible in the least number of working hours. Our government is afraid to tackle this monopoly. We find our political leaders submitting more and more to organized labor. The present railroad situation is a straight consequence. The trade-union spirit on the railroads is destroying essential discipline and earning power. We can hope for no remedy of this evil from either the national or state governments. Politicians are becoming more and more afraid of organized labor, despite the fact that there are only about 2,000,000 votes out of that class in the total of 17,000,000 voting strength of this country."

✂

The Mexican situation is still situated in Mexico. Maximo Castillo, however, is a prisoner in the United States, along with a number of his countrymen. What we are going to do with them is a question as hard to answer as the one which inquires what the outcome is going to be in Mexico, and, still more important, when? The problem is simple as the riddle of the Universe—just about. Only one point is clear, and that is that the United States Government will continue to do what it has in the past—pay! Castillo vehemently asserts that he is not responsible for the Cumbre tunnel horror, and offers to prove his innocence by referring to some Americans. He thinks Villa's men are the guilty ones. Villa could probably prove, by Americans, that he is not guilty. Americans in Mexico seem to be as useful as Eskimos in scientific circles. Whoever is responsible, we can and probably will pay. Mexico is in truth a sore spot on nature. Every one of us have in mind a cure that would undoubtedly be efficacious, but we do not happen to be the doctors in charge, and there is little to be gained by abusing those who are. We may take it for granted that they have given some study to the matter, and that their combined intelligence is probably almost equal to ours. Perhaps a liberal application of ammunition antiseptic and a watchful poultice may clean up the trouble in time. Anyway, we can continue to hope so.

PERSONALS

E. M. Johnson has resigned his position as manager of the National Zinc Company.

Harry G. Hann is drilling alluvial ground for the Lenskoi Gold Mining Co., in Siberia.

Dr. Alfred Stansfeld has completed the revision of his book on the Electric Furnace.

Dwight E. Woodbridge, of Duluth, is at Washington, D. C., where he expects to remain on professional business for a month or two.

R. B. Brinsmade has been making mineral surveys in the central part of the state of Jalisco, Mexico, with a view to starting development.

Dr. Gilbert Hartin, of Nelson, B. C., has been elected president of the Utica Mines Co. and C. F. Caldwell, vice-president and managing director.

Charles Brouard, a mining engineer, resident in England, is in Ottawa, making investigations preliminary to a trip for exploration work in Ungava.

William H. Hulick, of New York, has been elected president and treasurer of the Warren Foundry & Machine Co., Phillipsburg, N. J., succeeding William Runkle, who recently died. Mr. Hulick has been vice-president of the company.

W. J. Elmendorf, manager of the Portland Canal Tunnels, Ltd., recently went south after having been in the Portland Canal district all the winter. He has since been visiting Tacoma and Seattle, Washington, on business matters.

Roy H. Clarke, formerly associated with mining in Rossland camp, recently resumed practice as a mining engineer with office in Spokane, Washington, after having been for three years engaged in investigating mining properties in the southern states.

H. C. Slein, general sales manager of the Stromberg-Carlson Telephone Manufacturing Co., makers of the mine-aphone, has resigned to become advertising manager of the Yawman & Erbe Co., of Rochester, N. Y. Mr. Slein's connection with his former company extended over a period of 10 years.

A reward of \$500 is now offered by his wife and friends for any information which will lead to the discovery of William H. Marston, whose disappearance we have before noted in the "Journal." He is an English mining engineer, aged 30 years, 6 ft. tall, has light brown hair and stoops very noticeably.

Wenceslaus Prout and his wife celebrated the 55th anniversary of their wedding in New York, Feb. 21. Mr. Prout was born in Bohemia, and for many years was engineer in the Schwarzenberg silver mines. He came to New York in 1885, and for 20 years was in practice as a mining engineer, retiring about seven years ago.

K. A. Schleifer leaves this week for San Francisco, after having spent a month in New York, on his return from Macequesi, Portuguese East Africa, where he has been engaged for about a year in drilling on the Revue River Valley for Andrada Mines, Ltd., a French company, which has erected a dredge and is about to begin operations.

OBITUARY

Henry M. Teller, for over 30 years United States Senator from Colorado, who was noted for his persistent advocacy of free silver, died at Denver, Feb. 22, aged 84 years.

Victor Slaughter, of Bishop, Calif., it is believed, was killed in a snowslide below Lake Sabrina. It was a double slide, traveling from both sides of the cañon and filling cañon 40 to 60 ft. deep and about 1500 ft. long above top of Cable hill.

Jacob L. Holland died at Pilot Hill, Eldorado County, Calif., Jan. 24, aged 77 years. He was a pioneer in Nevada, Placer and other northern mining counties of California and traveled extensively in the mining districts of Alaska and South America.

Benjamin Illingworth died at Jersey City, N. J., Feb. 22, aged 93 years. He was a pioneer steel maker and was well known in the trade for many years, and until he retired 20

years ago. He established and conducted steel works at Newark, Rockaway, Pompton and finally at Jersey City.

William R. Thomas died at Palo Alto, Calif., Jan. 17. He was for many years engaged in mining enterprises in Nevada and Amador counties and in other parts of California. He operated the Central Eureka, one of the prominent mines of the Mother Lode and was one of the men who first made that mine a producer.

Dennis Fahey, a California pioneer, died at Sonora, Calif., Jan. 30, aged 83 years. Mr. Fahey was born in Ireland, and came to America, at the age of 19, stopping at New Orleans until the gold excitement started him for California. He was one of the early miners in Tuolumne County, making his home at Sonora since 1856.

Robert Kennedy Duncan, director of the Mellon Institute of Industrial Research of the University of Pittsburgh, died at Pittsburgh on Feb. 16, after an illness of several weeks. He was born at Brantford, Ontario, Canada, in 1868, the son of Robert Augustus and Susan Hawley Duncan. He was graduated from the University of Toronto with first-class honors in physics and chemistry in 1892, was a fellow in chemistry of Clark University, 1892-3, and a graduate student in chemistry, Columbia, 1897-8. From 1893-5 he was an instructor in physics and chemistry in the Auburn, N. Y., Academy High School, from 1895-8 at Dr. Julius Sach's Collegiate Institute, and from 1898-1901 at the Hill School, Pottstown, Pennsylvania. He studied abroad in 1900, 1903, 1904 and 1907, was professor of chemistry at Washington & Jefferson College 1901-6, and became professor of industrial chemistry in the University of Kansas in 1906. In 1910 he was made director of industrial research, University of Kansas, and director of industrial research and professor of industrial chemistry at the University of Pittsburgh. He was the discoverer and patentee of several new industrial processes and was a prolific contributor to the newspapers and magazines. He was the author of "The New Knowledge," 1905, "The Chemistry of Commerce," 1907, and "Some Chemical Problems of Today," 1911. Dr. Duncan had a remarkable gift of writing about abstruse phenomena of chemistry and physics in an interesting way and presenting his subjects so as to bring them within the understanding of the layman. His books were far from being great contributions to science, but as popular presentations they were works of art. Among Dr. Duncan's recent technical work was a study of copper leaching in behalf of the Inspiration Copper Company.

SOCIETIES

American Institute of Chemical Engineers—The sixth semi-annual meeting of the Institute will be held at Troy, N. Y., June 17-20, next.

Columbia University—Three prizes have been offered by the committee on the celebration of the fiftieth anniversary of the School of Mines, Columbia University, two of which are open to all graduates of Columbia, and the other open to all. The prize open to all is \$100 for a poster which shall fittingly indicate the anniversary, and the judges will be Austin W. Lord, Dean of the School of Fine Arts at Columbia, Edward H. Blashfield, and Robert W. Chanler, and designs must be submitted on or before March 15. The other prizes are \$50 each for a Columbia song, and a Columbia poem, for which entries will close May 1. All competitors must send their work to Frank D. Fackenthal, secretary to the committee, at the University. The judges of the poems and songs will be John Kendrick Bangs, Brander Matthews, John Erskine, Frank Dempster Sherman and Walter Henry Hall. Plans are practically completed for the celebration, which will begin on May 28 with a reception in the gymnasium at which the alumni will be welcomed by the president of the University, the Dean of the School of Mines, the senior professor, Henry S. Munroe, the chairman of the Celebration Committee, and their wives, while the other members of the faculty and the committee and their wives will assist. In the forenoon of May 29 there will be a big meeting in the gymnasium at which President Nicholas Murray Butler will preside, and degrees will be given to prominent alumni of the School of Mines. It is also expected that there will be sectional meetings of the various engineering graduates in the afternoon, with the first lecture in the Charles F. Chandler Foundation by an eminent chemist, at which Dr. Chandler, the last survivor of the founders of the School of Mines, will preside. The celebration will close with a banquet at the Waldorf-Astoria, at which prominent graduates will speak.

Editorial Correspondence

SAN FRANCISCO—Feb. 19

The Hall Process for Desulphurizing Copper Ores being tried out at the Balaklala smelting works at Coram, Shasta County, is reported to have been fairly demonstrated, though the time for complete demonstration has not elapsed. The present undertaking will probably be completed at the end of February. The percentage of sulphur removed so far has been in excess of 50% and the amount is being increased by further adjustment of the mechanical construction. Some of the treated ore has been shipped to the Mammoth smelting works at Kennett. The total shipments of ore direct from the mine and including the treated ore amount to about 200 tons per day. Shipments to other smelting works continue, and the mine is working about 100 men per day; some of whom are doing repair work in tunnels, and there appears to be general preparation for continued and extensive development and extraction of ore. This is not meant to affirm that the Hall process has been accepted, but that the Balaklala is likely to resume permanent operations in any event. There is no reason, however, to believe that the present method of desulphurizing the ores will not be adopted.

DENVER—Feb. 21

A Consolidation of Labor Organizations, the United Mine Workers of America and the Western Federation of Miners may result from actions that have been taken in the appointment of committees from both bodies who will arrange for a conference on this topic, probably in Denver. If the committees agree to the proposition, it will then be presented to the main bodies at their next annual conventions for approval. Mr. Moyer thinks that Denver may be chosen as the headquarters for the consolidated organization. He has announced that the Federation is having a bill prepared for presentation before Congress making it a felony for a mine employer to discriminate against a workman because of membership in a labor organization.

SALT LAKE CITY—Feb. 19

Damage to Crops has been the subject of some talk by farmers in Tooele Valley, claiming that the International Smelting & Refining Co.'s plant has been detrimental to crops. The company has employed agricultural experts who have investigated the effect of the smoke on the fertility of the surrounding soil. Records of conditions in this region were collected before actual smelting was begun. It has been impossible to find any evidence of injury to crops.

Solar Salt Works companies are beginning preparations for the season's work at the evaporation plants on the shores of Great Salt Lake. Ponds, ditches, flumes, etc., are being repaired and put in working order. Pumping usually begins in March. The ponds are an acre or more in extent, and are filled with salt water from 6 to 12 in. depth. As this evaporates, more is pumped in until the end of the season, when they are allowed to dry up. The harvest comes in October, and the production is 600 to 1000 tons per acre, according to the season, amount of rainfall, evaporation, etc. A part of the salt is refined for domestic use, but much of it is sold in the crude state to stockmen and packing houses.

MAQUETTE—Feb. 20

Carbide Lamps Have Superseded Candles at the Cleveland-Cliffs Co.'s Negaunee and Maas mines at Negaunee. Hereafter candles will be prohibited. Many of the men have been using carbide lamps for months, but heretofore the lamps have not been required by the officials. The men purchase their own lamps at the mines at wholesale price, and all of the carbide needed is supplied free of charge. At the beginning of each shift each man is given a 6-oz. can of carbide. Experiments have shown that the gas lamps cost less in the long run than candles. The men formerly took many more candles into the mines than they needed and the loss from waste was large. In many cases the men forgot the candles, and oftentimes small fires were started. The 6 oz. of carbide given each man daily is plenty to furnish light for an 8-hr. shift. In the experiments it was found the lamps required four fillings of carbide daily, 1½ oz. to a filling.

Rebuilding the Hamilton Shaft at the Steel Corporation's Chapin mine at Iron Mountain is two-thirds completed. The shaft is being lined with concrete from top to bottom, a distance of 1430 ft. The concrete has been carried down 1000

ft. to the 12th level, where a station 30 ft. wide and 100 ft. long is being made. In this station there will be installed an electrical centrifugal pump of large capacity, current for the operation of which will be supplied by the company's own hydro-electrical plant, now under construction at the Quinnesec Falls of the Menominee River. A similar pumping station will be built at the 16th or bottom level. The shaft is 9x21½ ft. inside dimensions, as it is being rebuilt, and has eight compartments, two for ore skips or water bailers, two for cages, three for pipes and transmission cables and one for ladders. Concrete slab partitions separate the compartments. The concrete walls are 6 in. thick, reinforced with steel. They have been built at the rate of 65 ft. per month, the work having been retarded owing to the poor condition of the old timbers and the difficulty of removing them and also by an unexpected ingress of water, which caused the loss of a full month's time. Forty men are employed in the work. Operations are carried on in three eight-hour shifts. With the walls completed the Hamilton shaft will become the permanent and principal outlet of the Chapin mine.

IRON RIVER—Feb. 20

Increased Activity at Iron River is noted. Much exploratory work has been done during the winter and much development work. Actual mining has lagged, however, and importance of the field considered, little ore has been put in stock. Production now is being expanded. It is predicted that more men will be employed in the Iron River district in the coming season than has been recorded in any former year. Several new properties will become shippers. The Zimmerman mine is again in commission, after a suspension of several months. Full shifts will be at work shortly. The Hiawatha, Rogers and Chicago properties of the Rogers-Brown Ore Co. have been producing steadily throughout the winter, but on a scale materially below capacity. Working forces now are being increased and it is understood large shipments will be made the coming season. The Wickwire Mining Co.'s Homer mine also is expanding operations. The property has been equipped with a steel shaft house and is in position to produce a record tonnage. The suit whereby Paul Schook, of Crystal Falls, seeks to obtain a one-third interest in the Zimmerman mine has been submitted to Circuit Judge R. C. Flannigan on briefs by the opposing attorneys. The defendants are Eugene Zimmerman and G. C. Clutts, of Ohio. Schook claims he was instrumental in bringing about the deal resulting in the acquisition of the property by the present operators and that it was agreed he was to have an interest in the rights. The Zimmerman man is valued at \$3,000,000. Pickands, Mather & Co., of Cleveland, have been making various improvements at the Iron River mines during the dull season. Not as much ore has been stockpiled as in former winters, but considerable development work has been done, and if market conditions warrant the usual tonnage can be shipped. It is understood that as yet the firm has sold little or no ore. However, it is considered that the buying movement has merely been delayed. The shaft at the Baltic mine has been overhauled and both the Baltic and the Bengal are ready to produce at any time. The Caspian is, as usual, prepared to forward a large tonnage. It is expected that a contract for stripping Pickands, Mather & Co.'s Balkan property at Alpha will be awarded shortly, revised tenders having recently been submitted by various companies. Exploratory work has established that the area from which the overburden is to be removed is not as large as first estimated. Nevertheless the stripping work will be of unusual proportions for Michigan and will approximate 1,000,000 cu.yd. The Peninsula Power Co., of Iron Mountain, which is supplying several of the Iron River mines with current generated at its hydro-electric plant on the Menominee River, is preparing to enlarge its Iron River auxiliary station. A brick power house will be built and equipped with two new units, increasing the capacity of the auxiliary plant from 1000 to 3000 hp. Two additional units are being installed in big plant on the Menominee River.

FREEPORT, TEXAS—Feb. 21

A New Electric Lighting and Power System is to be built soon suitable to meet the needs of this growing seaport. A new central electric-power plant has been recently included in the plans for the new superheated water and power plant

now being erected at the Freeport Sulphur Co.'s mines at Bryan Heights, and will be built in a few months. This plant will supply electric light and power to Freeport. The amount of electricity furnished will be ample for a large city, meeting all the requirements of the present and for some time in the future. It will take the place of a much smaller plant now in operation, and do away with the need for a larger plant being installed in the city for years to come. The current will be generated by a 200-kw. Westinghouse steam turbine, direct connected to a generator. This central power station will be large enough to supply all the power required at the mines at Bryan Heights, such as operating pumps, to pump water from the canal, and fuel oil from the storage tanks on the Freeport ship channel to the mines, providing power for the machine shop and for commercial and domestic lighting and power at Freeport. The station will be built by the Westinghouse-Church-Kerr Co., in connection with the \$125,000 plant now being put in by the sulphur company. The new sulphur conveyor and loading devices installed by the sulphur company at the Seaboard & Gulf steamship pier on the Freeport ship channel, which has a capacity of 3600 tons per day for loading vessels with sulphur, is now completed, and ready for operation. It is expected that the first shipload of sulphur will leave here on one of the Seaboard & Gulf Steamship Co.'s boats within a few weeks. A new loading equipment for handling this product at the mines has also recently been installed and is now in operation. It consists of a "Brown-hoist," with a loading capacity of 30 carloads of sulphur per day. With a railroad to the mines, and loading equipment at both the mines and at tidewater now installed and in operation, the shipment of a considerable tonnage of sulphur from Texas' only sulphur mines can be expected for 1914, and this state from now on can be expected to figure prominently in the sulphur production of the world.

SILVER CITY—Feb. 19

Phelps-Dodge Activity in the Burro Mountain District has called the attention of others to that region, owing to the construction of a branch railroad from Whitewater on the Santa Fé to Tyrone and the recent driving of a 7000-ft. tunnel connecting Leopold and Tyrone. The district is being seriously studied by several mining companies with an object of developing property surrounding the Phelps-Dodge holdings, which it is understood, can be secured at a fair price. Several options have been taken within the last few months but as yet very little development work has been done. A few shipments have been made recently from White Signal with good smelter returns and lessees declare the outlook to be good. Between White Signal and Tyrone regions extensive development work by churn-drilling is warranted and it is the belief of mining men in the district that profitable ore will be encountered at depth. A pipe line from the Mangas River, it is thought, will solve the water problem and the construction of the railroad has lessened the cost of supplies. Labor in the district is plentiful.

JUNEAU—Feb. 1

Demand for a Mining and Metallurgical Laboratory, to be established by the Bureau of Mines, is the first recommendation contained in the first annual report of the territorial mining inspector, William Maloney, which has just been submitted to the governor. Mr. Maloney also recommended that the eight-hour working day be extended to all underground employees, whether they are working in quartz or placer; that the owners and operators of mines should be required to register with the mine inspector and set forth the name of the mine, its character, the location, name of person in charge, principal place of business, the number of actual employees and prospective number of employees, etc.; that the mine inspector should be provided with blanks for reports to be made by mine operators and their agents, setting forth these and other particulars, including accounts of accidents, etc.; that it should be a crime for any operator or employee of a mine to willfully and wantonly neglect any precaution against endangering life or injury, or to violate the rule provided for their safety; and that the mine inspector should be provided with funds for office assistants and deputies to assist in field work. He particularly asks that deputies be provided to visit new camps. Mr. Maloney reports that 24 lives were lost last year through accidents in mining operations, 15 of them in the quartz mines and nine in placers. He finds that quartz mining is becoming important in the Fairbanks and Nome districts, but the operations are confined to the richest lodes on account of high cost of production, due to excessive transportation charges. The report says that 40 dredges are operated on Seward peninsula and that 300 men are employed in their operation. The inspector says that there has been too little development work in the Chisana.

Nelchin and Adreanofsky strikes to determine anything as to their richness or extent.

COBALT—Feb. 21

Nipissing Annual Report will be of special interest in view of the recent drop in Nipissing stock and the belief that this was a forerunner to a cut in the dividend. The statement of the President, E. P. Earle, is also of interest. He states that the report for 1913 will be sent to the shareholders in April and will contain full particulars concerning operations for the year ended Jan. 31, 1913. Inasmuch as there has been of late a falling off in the net earnings due to the lower average grade of ore produced and as it is impossible for the management to state whether this condition will prove temporary or permanent, it is deemed advisable at this time to submit a brief statement to the stockholders. The nature of the orebodies in the Cobalt district is such that it is impossible to predict earnings far in advance. The earnings of the company will in the future, as they have in the past, depend on the continuation of the veins now known and being operated and the discovery of new orebodies. There have been periods in the past when earnings have fallen off because of conditions similar to those now existing. The company owns a large area of undeveloped territory which presumably contains orebodies of value. Mr. Earle states further that during the last three months, five new veins have been found in partially developed ground and will aggregate about 8 in. of 2000-oz. ore. He also states that on Jan. 1, the company's ore reserves were practically the same as those that existed on Dec. 31, 1912, when they stood at 9,643,338 ounces.

SUDBURY—Feb. 21

International Nickel Employees took advantage of the recently made stock offer. Practically all of the 3000 shares of common stock offered for subscription to employees and officers at \$110 has been subscribed for. Of the 4000 persons on the pay roll, about 40% subscribed for their allotment of shares. The minimum subscription was one share to any employee of under five years service and receiving up to \$825 yearly, while the maximum subscription was 10 shares to anyone receiving over \$4000 yearly and who has been in the employ of the company for over 10 years. This stock will be paid for in monthly installments and the employees will receive dividends as soon as the first installment is paid. An additional bonus equal to 5% on the stock so paid for, will be disbursed annually to such employees as retain their stock and remain in the employ of the company. The success of this innovation has been gratifying to the International Nickel Co. which controls the Canadian Copper Co.

QUEBEC—Feb. 21

Black Lake Asbestos Co.'s statement for 1913 is not likely to bring much joy to the shareholders. The company reports a loss of \$20,939 on the year's operations. From the figures available, it does not appear that the company sold any asbestos in 1913, as the only receipts given in the profit and loss statement are \$1617 for rents and \$4796 for interest, against an expenditure of \$27,352. The report of the directors states that the results of the last year's operations have been unfavorable, owing to the decline in the percentage of asbestos obtained from the rock. Due to a change in formation in one of the largest pits, the percentage of asbestos fiber in the rock dropped from 5.1% for the first six months of the year to 3.8% for the last half of the year. It is stated, however, that new pits are being opened which will furnish rock equal to the best now being mined. Current assets including \$73,000 loaned on collateral security amount to \$150,881, while current liabilities including a bank overdraft of \$23,366; total \$29,616. The company states that its entire estimated output is contracted for up to next October at advanced prices and the indications are that further advances in price may be obtained for rest of the output.

TORONTO—Feb. 21

A Petroleum Regulation Bill was introduced Feb. 20 into the Canadian Parliament at Ottawa by Hon. J. D. Reid, Minister of Customs, giving the government power to regulate or prohibit the exportation of crude or partly manufactured petroleum. This was done in accordance with the urgent request of the British Admiralty. Premier Borden, in explaining the bill, stated that it was not the intention of the Government to exercise the powers granted by the proposed legislation for any commercial reason, but it was considered desirable in connection with matters of importance to the defense of the Empire. Conditions might arise when it would be necessary to prevent oil of a certain quality from being exported to any foreign country. Private interests would have to be considered and to receive compensation if the legislation were acted on.

The Mining News

ALABAMA

Bibb County

A DECISION IN THE CASES ON TAXES OF LEASES ON mineral lands was rendered by circuit court of Bibb County in favor of the lessees. This affects tax assessments on property valued at from \$3,000,000, to \$5,000,000 involving right to assess lessees of mineral lands.

Jefferson County

ATTALA LIME & LAND CO. (Birmingham)—Company was recently incorporated with nominal capital of \$5000 to develop quarries.

TENNESSEE COAL, IRON & R.R. CO. (Ensley)—Work has commenced on rebuilding No. 6 furnace. It will be enlarged and when completed will be one of the most modern in the South.

LACEY-BUCK IRON CO. (Birmingham)—Bill of complaint filed in U. S. court by Continental & Commercial Trust & Savings Bank of Chicago seeking to foreclose lien of a trust deed of \$500,000 given by defendant and asking that a receiver be appointed for that purpose.

ALASKA

PASSAGE OF THE ALASKA RAILROAD BILL by the Senate was received with general rejoicing and press of territory is unanimous in predicting opening of Alaska and increase in development work in mining and agriculture. Fairbanks, which is considered interior terminus of any government railroad, was wild with excitement. A parade of all public bodies was held and business houses closed for the day. Miners from all outlying districts who could be advised of the passage of bill came to the city. Now that it appears that Alaska will get some consideration, there is a general expression of good will toward the administration at Washington that has never existed up to the present. If the proposed road is built to Matanuska coal fields, as seems practically certain from report of Alaska railroad commission, 135 miles of road will have to be constructed before any Alaskan fuel other than that owned by W. J. Whorf at Seldovia becomes available. Whorf has had dealings with the government for several years in supplying fuel, and last summer loaned the Matanuska coal-field expedition, conducted under the direction of the Navy Department, a big scow, which was afterward wrecked in Cook's Inlet. For several years Whorf landed coal on his dock at Seldovia and sold it to the government at \$4 per ton, the fuel being used by U. S. revenue cutters and vessels engaged in the coast and geodetic survey work. It is understood that Whorf will be given an opportunity to bid on supply of a large amount of coal to be used by the government, presumably in the construction of the proposed railroad. When conservation mania swept country, Whorf was arrested and fined for selling coal to government, and thereafter Treasury Department paid \$15 per ton for its fuel, brought from British Columbia, and paid Whorf \$2 per ton for privilege of landing it on his dock. This procedure was carried on until summer of 1912 when Whorf was granted a patent to his claim on a direct order from President Taft.

ARIZONA

Gila County

OLD DOMINION (Globe)—Only construction work at present proceeding is completion of concentrate bins and concrete tanks. Experiments are still being continued in old concentrator to determine best method of concentration, but it is anticipated that a definite decision will soon be made, and that remainder of equipment for new concentrator will be ordered soon. In mine ore production and development work is being increased somewhat. Motor haulage is being installed on 1200, heavy rails are being laid and trolley wire strung along drifts. Two 3-ton locomotives have been ordered for this service. On 1800 level foundation for a Worthington pump has been finished and pump will be running soon. Excavation for big pump station on that level will commence immediately, and a drift will be driven over to "A" shaft. Winze to 1800 in west end of mine has also been started, and headframe and hoist will soon be in place. A large two-compartment skip pocket is being cut below 1600 level station at "A" shaft. At Grey mine a hoist has been moved down from Buckeye mine for temporary service while foundation under present hoist is being removed to make room for a new and larger hoist. Steel and corrugated iron for change room at Grey is now completely erected, and lockers and other equipment will soon be installed. Smelter is running three furnaces on normal tonnage.

Maricopa County

BLACK BUTTE GOLD & COPPER CO. (Arlington)—It was reported some time ago that John Ambrose had sold his group of claims to Colorado men. This is a mistake, as group of claims formerly owned by Lars Anderson has been purchased instead, and this company was organized for purpose of developing this promising group of claims.

CALIFORNIA

Amador County

BUNKER HILL (Amador City)—A 2-ft. vein of good ore is reported in 2100-ft. level. Cleanup for last month reported above average.

GRILLO (Volcano)—It is reported that sale to W. I. Smart & Co., has been consummated. Development of gravel channel is in progress.

ORIGINAL AMADOR (Amador City)—William Deane, superintendent, has resumed active charge. Old north shaft will be retimbered, affording better ventilation and improved extra exit.

DEFENDER (Defender)—New oreshoot is reported. Extraction and milling of ore are now regular, since water is abundant. Probability of installation of electric power at this and other mines in district.

PLYMOUTH CONSOLIDATED (Plymouth)—New four-room office building is nearing completion. It will contain separate room for superintendent, draftsmen, bookkeepers and change room. Grading for new mill has begun.

ZEILA (Jackson)—Extraction of ore from new orebody in winze on 1500-ft. level is suspended pending outcome of negotiations for sale to Breitung & Co. Underground men have been reduced from 27 to 20. Pumps are keeping mine unwatered. Some surface ore is being milled.

KENNEDY EXTENSION VS. ARGONAUT (Jackson)—Transcript of arguments of counsel has been filed with court, and 60 days may elapse before Judge Wood delivers his decision. Since conclusion of trial Kennedy Extension has done no development under ground, but pumps are kept going. Argonaut continues mining and milling, operation has not been interrupted at any time during preparation or trial of suit.

Butte County

CARLISLE (Forbestown)—Mine has been reopened. Large amount of development planned.

ST. FRANCIS (Forbestown)—Small stamp mill is being built for extensive development and sampling.

BEIK (Forbestown)—Development by tunnel to be 600 ft. long in progress. Property lies east of Gold Bank.

GOLD BANK-GOLDEN QUEEN (Forbestown)—Work is being done on new claims adjoining, by Forbestown Consolidated Gold Mines.

BURLINGTON (Forbestown)—Development has been resumed since weather cleared. Indications are good for extension of orebodies already developed.

NUCKET GRAVEL MINING CO. (Chico)—New incorporation, \$150,000 capital stock all subscribed, to develop drift mine near Chico. Directors: C. F. Dyer, George C. Allen, E. L. Meyers, of Chico, J. D. Hubbard, of Santa Clara, James Spiers, of San Francisco. Much drift gravel-mining in progress in district.

Calaveras County

CALAVERAS COPPER CO. (Copperopolis)—It is reported that \$10,000 is to be distributed to stockholders and creditors. It is expected company will be reorganized on a working basis and that mine will resume production.

Inyo County

BISHOP-LUNDY POWER CO. (Bishop)—Line riders report 15 ft. of snow at Eaton place in Long Valley.

CRYSTAL LAKE MINING CO. (Lundy)—It is reported that a snowslide has wiped out power plant. Safety of watchman at mine, about four miles from town and 1000 ft. higher elevation, is assured, so long as he does not venture away from mine, as he is well housed and provisioned.

Merced County

YOSEMITE MINING & DREDGING CO. (Snelling)—A new dredge is being built for the company at Merced Falls to take the place of Yosemite No. 1. It is a small, wooden boat, 75x38½x6 ft. depth. Part of the machinery from old dredge will be used, replacing those parts that are worn out, including new ladder complete, new hopper, new bucket bottoms and considerable operating machinery.

Modoc County

BIG FOUR (High Grade)—Sturtevant and Wade, claiming that assessment work was not legally done for 1913, have filed on property. Owners have sought an injunction.

HESS MINES CO. (Alturas)—Fourteen men are now employed working two shifts and developing good ore on 250-ft. level. Mill was closed in December, but was expected to resume in February.

Monterey County

BUCLIMO MINING CO. (San Francisco)—An assessment of 3c. per share has been levied on capital stock, payable on Jan. 24. Mine is in Los Burros district.

Nevada County

GOLD MOUND (Grass Valley)—Mine has been closed down, owing to disappearance of F. Lewis Clarke, of Spokane, who had financed property for exploration and development. Clarke recently disappeared from Santa Barbara, where he and his wife were visiting.

Plumas County

CROWN POINT (Quincy)—Preparations are being made for installation of ground sluicing system.

MOHAWK (Vinton)—It is reported that this copper property in Last Chance valley has been sold by M. J. Daily and C. H. Duborg to Salt Lake men. Development last year is said to have disclosed high-grade copper and gold bearing ores. Four carloads were shipped to Salt Lake smelters.

Tuolumne County

CARLIN (Jamestown)—Mine, which has been developed by Jamestown Exploration Co., has been taken over by Stockton men, J. H. Ott and others.

COLORADO

Boulder County

GOLDEN SLIPPER (Boulder)—This mine, idle since 1907, is to be reopened by a leasing company.

Clear Creek County

SEVEN-THIRTY (Georgetown)—Work has resumed in this old, rich lead-silver mine.

BURNS-MOORE (Idaho Springs)—Through foreclosure proceedings this property reverts to its original owner, Dr. J. M. Shaler.

TRAIL CREEK (Idaho Springs)—Property about 5 miles from town has been sold to Eastern men who intend to start work immediately.

MC CLELLAND TUNNEL (Idaho Springs)—Will be reopened, cleaned out, and pushed to tap Freeland vein, when it will be extended along vein to connect old workings.

ALBRO (Idaho Springs)—Swanson, Dingle and Shaffer are driving crosscut and drifting on vein. No shipments made but ore has been stocked waiting for opening of snow-blockaded wagon roads.

SPECIE PAYMENT (Idaho Springs)—Mining is done through Two Brothers tunnel and a raise is being lifted to connect with old surface workings. Ore is being concentrated in Combination mill.

CENTENNIAL (Georgetown)—A new mill for amalgamation, concentration and cyaniding is contemplated to treat several large dumps built years ago when mine produced good ore. Sampling shows dumps to average \$3.60 per ton. Ore ranging from \$7 to \$12 per ton is being blocked underground.

Eagle County

NORTH DAKOTA (Eagle)—Lies adjacent to Lady Belle and has good showing of carnotite ore.

LADY BELLE (Eagle)—Shipments being made from a new rich shoot of silver ore. Mine has also carnotite ore.

Gilpin County

COLORADO CARR (Central City)—Eleven sets of lessees have recently reopened this old mine and are making small but rich shipments.

GERMAN AND BELCHER (Central City)—About 150 tons of pitchblende ore has just been shipped to Denver. Most of this is low-grade. About 8½ tons, valued at \$65,000 to \$80,000, was shipped in guarded, sealed box-car. Content of uranium oxide ranges from 30% to 60% in different sacks. Said to be largest single rich shipment ever made.

Gunnison County

ACTIVITY IN ALL CAMPS OF THIS COUNTY, especially at Crystal, Ohio City, Pitkin and White Pine is being shown. Quarries at Marble are preparing for large shipments to fill Lincoln monument contract.

Lake County

GRANITE TUNNEL (Granite)—Will be driven 240 ft. to reach Yankee Blade vein.

BLOCKADES OF RAILROADS within district are broken and mines are being furnished with cars. Shipments have resumed from many mines that were obliged to close down temporarily.

EVENING STAR (Leadville)—Company has about 20 men stoping lead and iron ores. Lessees are shipping 1000 tons per month assaying 6 to 18 oz. silver in ore averaging about 45% excess iron.

La Plata County

HONEY DEW (La Plata)—Bacon & Son are stocking ore estimated to assay over \$50 per ton.

San Juan County

TRUST RUBY (Silverton)—J. H. Slattery has opened a vein of good lead-silver ore.

HAMLET (Howardsville)—Driving of two raises and a winze is developing reserves that will later be treated in 50-ton mill.

SILVER LAKE (Silverton)—Lessees are working through Unity tunnel and blocking ore for summer shipment. Silver Lake tunnel is being re-opened and a jig-back tram is being built to connect with Iowa aerial tramway and thus obtain transportation down to railroad and mill in gulch.

San Miguel County

JUNTA (Telluride)—New mill is doing good work.

WELLER (Telluride)—Heavy winds recently swayed buckets on aerial tramway so much that they demolished the heads of towers. Mill obliged to close down temporarily, but is running again.

Teller County

ELKTON (Eikton)—About 50 applications for leases on upper levels have been received. Active work by lessees is expected to start soon.

FOREST QUEEN (Cripple Creek)—Lessee John Connor is making an excellent showing in shipments this month from this Ironclad Hill property.

PORTLAND (Victor)—Sinking in No. 2 shaft has been discontinued on account of reaching water level. Work has been started on 1750-ft. level.

AJAX (Victor)—Preparations continue for reception of custom ore at the Colburn-Ajax mill. A reduction of 25c. per ton from prevailing rate of treatment has been announced.

GOLD KING (Cripple Creek)—Company has just issued its annual report. This mine, situated in Poverty Gulch, has distinction of being first shipping mine in Cripple Creek district, and still ranks among consistent producers.

IDAHO

Coeur d'Alene District

CROWN POINT (Kellogg)—This property in Government Gulch, operated by Frank Rowley and A. Cooper, is preparing for its first shipment of high-grade ore. Old property has been cleared out and stoping operations are under way. Crown Point was one of the richest small mines in district several years ago and was later abandoned because of ore running in pockets. Rowley and Cooper have opened up some good ores. It is reported that lessees are planning to erect a small mill in spring to handle low-grade product.

HYPOTHEEK (Wallace)—Plans are under consideration for increasing capital stock from 1,500,000 shares at 10c. par to 2,000,000 and a special meeting of stockholders has been called at Wallace, Mar. 10, to discuss proposal. Call states that if increase is authorized a portion of added capitalization will be devoted to constructing a 300-ton concentrator on railway near property, installing a tramway from mine to mill and fully exploring lower workings of mine, in which important showings of ore have been reported at intervals for several months. Development and operating expenses at Hypotheek heretofore have been financed by frequent assessments on outstanding stock, but directors state that further assessments will not be necessary if increase in capitalization is authorized.

LUCKY FRIDAY MINING CO. (Mullan)—Company has been reorganized. New concern is capitalized for same amount as old, 1,500,000 shares, at \$1 par, and there are 170,000 shares in treasury. It is planned to levy an assessment of 3 mills on 1,330,000 shares outstanding, which will provide a fund of \$3990, enough to liquidate existing indebtedness and leave a balance of \$438 as nucleus of a working reserve. Mine, once regarded as among the most promising undeveloped properties in Mullan district, is said to be in good physical condition still, although idle for some time. It is developed by a tunnel 600 ft. long, and there is a complete equipment of track and ore cars, together with an electric drilling plant and necessary mining machinery. Approximately, \$20,000 has been expended to date on the property.

MINNESOTA

Cuyuna Range

NORTHERN PACIFIC RY.—Company has ordered 250 steel ore cars from Western Steel & Foundry Co., for delivery in June. These are for use on Cuyuna Range.

CUYUNA-MILLE LACS (Crosby)—Lower level of mine has been unwatered, and operations will start therein at once. A 50,000-ton output is planned for coming season.

SOO LINE RY.—Construction of new \$1,000,000 dock at Ashland, Wis., will begin at once. Terminal facilities at that point will also be enlarged considerably. This expansion is intended to take care of increased ore tonnage from Crystal Falls and Iron River districts.

JAMISON & PEACOCK (Crosby)—Cuyuna Realty Co., subsidiary of Northern Pacific Ry. Co., has completed its explorations on this 40-acre tract. Nearly 1,500,000 tons of bessemer ore have been demonstrated on the property, averaging 58.4% iron and 0.034% phosphorus, being only body of bessemer ore on the Cuyuna range which can be mined as bessemer ore, there being practically no interbedded low-grade material. One sample assayed 69.52% iron and 0.011% phosphorus, being nearly pure hematite. In addition, orebody contains a considerable tonnage of mineable nonbessemer ore. Following its usual procedure, Northern Pacific Ry. will sub-lease property to an operating company, thereby securing haul to Lake Superior docks for its lines.

Vermillion Range

MCCOMBER (Tower)—Orebody has been encountered on 100-ft. level. Property under lease to Mutual Iron Mining Co., which company also owns a platted townsite on adjoining ground, which is midway between Tower and Ely.

VERMILION & MESABA IRON CO. (Tower)—Shaft down 284 ft. and in lean iron formation. When the shaft reaches 300 ft., drifting will be started. Company is sinking a test pit 500 ft. northeast of the shaft, which is in iron formation at a depth of about 40 feet.

MISSOURI-KANSAS-OKLAHOMA

Joplin District

LEAD AND ZINC STRIKE IN TAR CREEK DISTRICT, near Hattonville, Okla., has been made by Captain J. A. Rogers and associates, of Joplin. Shaft has been in rich ore from 92 to 126 ft. and is declared by other operators to be best strike in district. Option on three-fifths of stock granted to New York men. First lease held by Commerce Royalty Co., of Miami, Okla.

JOHNSON & CO. (Cave Springs, Mo.)—Operators finding galena at shallow depth and believe good prospect will result.

BALDRY & CO. (Joplin, Mo.)—Mine now figuring weekly in production. Rich ore being hoisted from 60 to 70 ft. Lead and calamine found.

BENNETT & CO. (Joplin, Mo.)—Good orebody being developed at 42-ft. level. Lease is on Missouri Lead & Zinc Co.'s land. Lead ore prevails.

STUMP LEAD & ZINC CO. (Bell Center, Mo.)—Shaft is down to 115-ft. level, with 20-ft. face of mineralized ground available. Mine is in virgin territory.

WILLIAMS & FERNEAU (Galena, Kan.)—Company has opened good mine within city limits. Lease on four lots taken and lead ore has been found from 15 ft. to 35 ft.

MARY C (Thoms Station, Mo.)—Bed of coal has been encountered in this old mine and operators are arranging to market product, hoping to transform former zinc producer into paying coal mine.

TECUMSEH (Joplin, Mo.)—Concentrator, recently purchased by J. M. Short and associates, destroyed by fire. Cause unknown. Was erected several years ago and first operated as the Dividend.

MONTANA

Silver Bow County

PILOT BUTTE (Butte)—Case of Anaconda company against Pilot Butte, which was set for hearing next month, has been continued by agreement until June 8.

RAINBOW (Butte)—Crosscutting on 1000-ft. level has been going on steadily and about 100 ft. of it has been through vein which is one of the largest in district. It is reported that development work has uncovered extensive and valuable ore and that mine will soon enter list of producers.

SILVER BOW (Butte)—This mine, one of the smaller properties of Anaconda Copper Mining Co., has been temporarily shut down to make a large number of necessary changes and repairs, chief among which will be building of a new foundation for hoisting engine. Engine will be operated by steam as in the past although most of the company's steam hoists have gradually been converted into compressed-air hoists.

BELMONT (Butte)—Steel ore bins at this property of Anaconda company, first of kind erected in Butte, which were completed several months ago, were recently connected to collar of shaft by an overhead tramway and are now ready to receive ore. On lower levels Belmont is connected with Anaconda mine and it is surmised that much ore from that mine which heretofore was hoisted through Anaconda shaft will hereafter come to surface through Belmont shaft.

BUTTE & SUPERIOR (Butte)—Manager J. L. Bruce has returned to Butte from a trip in the East where he visited various mines and plants in New Jersey, Joplin district, West Virginia and Oklahoma. During his absence various improvements have been completed at mill at Butte, chief among them being installation of a Kelley filter for extraction of moisture from concentrates before shipping, thus reducing freight and smelter charges. A new timber-framing shop has been erected and connected by a new spur with shaft and other surface plants.

TUOLUMNE (Butte)—At annual meeting of stockholders, which has been called for Mar. 9, an effort will be made by certain factions to oust present management. Minority stockholders accuse managing majority of reckless and extravagant work and gross irregularities which, they claim, call for a change. Daniel Shields, a director and one of the original owners of the mine, is leading fight to gain control of company's management and to place its affairs on a sounder basis by acquiring more property so as more fully to realize benefits from a costly equipment which at present is only partly employed in useful work. Another faction of stockholders is opposed to purchase of new property suggested by Shields and from present indications there may be three sides to controversy by time of meeting.

ANACONDA COPPER MINING CO. (Anaconda)—Slime concentrating plant being erected at Washoe smelter is nearing completion. Work of concreting decks of 20 round-table machines is well under way, and is being done at rate of eight decks per day. There are 20 decks to each machine, making 200 decks in all. Big tanks, 50 ft. in diameter in dewatering division, have been completed and workmen are putting Oliver filters together. The force of men employed at the concentrator has been increased by a number of men formerly employed at Great Falls plant, a portion of which has been closed down and ore is going to Anaconda from Butte. Work of increasing capacity of concentrator and remodeling plant is well advanced and long before Great Falls concentrator is finally closed down concentrator at Anaconda will be in a position to care for all ore that formerly went to Great Falls.

BUTTE-DULUTH MINING CO. (Butte)—It is rumored that American Metal Co. is to become financial backer of this company, either by outright purchase of a controlling interest or by taking all or part of bond issue not yet taken up. Captain Wolvin left for New York recently to complete deal. In connection with this transaction first authentic statements regarding company's holdings and operations were made public through report of Walter Harvey Weed, who recently made a thorough inspection of property. Briefly, they are as follows: Property embraces 70 acres of ground in eastern part of Butte district, traversed by a mineralized zone of oxidized copper ore, 500 ft. wide and 2100 ft. long. It is estimated that tract contains some 5,000,000 tons of ore averaging about 2% copper. Ore is now mined and treated in a 100-ton leaching plant at a total cost of \$3 per ton. With a larger plant of, say, 1000 tons capacity cost should be reduced to \$2 per ton. Ore is mined under contract in open pits at 18c. per ton. After being crushed and screened it is delivered into Dorr agitators where acid is added in ratio of 67½ lb. of 60° sulphuric acid per ton of ore. Ore passes through Dorr machines in 32 min. and in that time gives up 88% of its copper. Solution is returned to agitators until it contains 4% copper and from 9 to 19% acid. It then goes to the cell room where copper is deposited by electrolysis. Waste solutions pass through launders over scrap iron where remaining copper is recovered as cement copper. Output for January, 1914, was 55,000 lb. of electrolytic and 40,000 lb. of cement copper. Leaching plant is being rapidly expanded and will ultimately have a capacity of 1000 tons per day.

NEVADA

Churchill County

NEVADA HILLS (Fairview)—Complete settlement of two suits against company, involving ownership of stock valued at \$500,000, was effected recently.

Elko County

COPPER QUEEN (Gold Circle)—Car of ore recently shipped from 95-ft. level of "B" lode assayed 0.155 oz. gold, 22.4 oz. silver and 12.45% copper. Drifting is being done on 100-ft. level of Ironsides shaft and from Granite shaft. Ore has been developed in both these workings. Morgan tunnel on Baltimore group is in 300 ft. and will be driven 200 ft. further on vein. Ore shows in tunnel and silver-lead ore of good grade has been shipped from outcrop. Tractor and trailers will be installed next spring in hauling ore. This is expected to reduce cost of transportation over that of wagon haulage sufficient to make it profitable to ship a large tonnage of low-grade ore now on dumps.

Esmeralda County

PITTSBURG SILVER PEAK (Blair)—Dividend of 2c. per share has been declared, making disbursement of \$55,000.

JUMBO EXTENSION (Goldfield)—Negotiations for purchase of Velvet claim of Goldfield Merger Mines Co. have been completed.

Humboldt County

RICH FLOAT IN LOWER ROCHESTER has been found. One piece assayed \$680. Rush has been on to scene of discovery.

FOUR J LEASE (Rochester)—Car of good-grade ore has been shipped. This is from 450-ft. level, deepest working in ore in camp.

ROCHESTER MINES CO. (Rochester)—All negotiations with Mexican Gold & Silver Mining Co., of Virginia City, for erection of a plant to treat Rochester ores, are ended. Apparent reason is suit involving a large block of Rochester Mines Co. stock.

Lincoln County

YUBA LEASE (Pioche)—New shaft house and headframe are being built at No. 3 shaft. Hoist will soon be installed.

GREENWOOD (Pioche)—Lessees have developed a large tonnage of ore on 350-ft. level. Hoist has been repaired and shipments will be made in near future.

AMALGAMATED PIOCHE MINES & SMELTERS CORPORATION (Pioche)—Shaft sinking from 1300-ft. level is underway. Bonus system is used with satisfactory results, 130 ft. advance having been made since its adoption. Work is also being done on 1200-ft. level.

Mineral County

NEW FREIGHT ROUTE TO AURORA is from Wilson, on Nevada Copper Belt R.R., up East Walker River. Road from Hudson is at present impassable.

AURORA CONSOLIDATED MINES CO. (Aurora)—Strike of rich ore has been made, it is reported, in bottom of shaft in old workings. An 8-in. streak assays \$700.

Storey County

UNITED COMSTOCK PUMPING ASSOCIATION (Virginia City)—Water level in northern mine is being held below 2700-ft. point. Repairs are being made to station on 2700-ft. level in Consolidated Virginia Winze, and 2500-ft. level in C. & C. shaft is being put into shape for working. Stewart and other pumps are working satisfactorily.

White Pine County

REDUCTION IN FREIGHT RATES on Nevada Northern R.R. of \$1 to \$3.50 per ton has been made on ores and concentrates valued at \$30 to \$300 shipped from East Ely, McGill, Warm Springs, Cherry Creek and Greens to any Utah smelting point. Rate per hundredweight on black powder, shipped from Cobre and Shafter to McGill and East Ely, has been reduced 7c. and on pig iron, 19.5c. per ton. These rates became effective Jan. 25, 1914.

LUCKY DEPOSIT—Vein assaying well in silver and copper has been cut. Drifting is now being done.

ELY CALUMET (Ely)—Shaft has reached 260-ft. point and is being sunk at rate of 2½ ft. per day. Shaft is in lime, and numerous stringers and kidneys of ore which show native copper and copper glance have been cut. When 300-ft. level is reached, station will be cut and crosscut driven to vein.

NEW MEXICO

Colfax County

GAS HAS BEEN STRUCK NEAR NOLAN by a prospector. Oklahoma men are endeavoring to secure lease on land on Mora-Colfax county line with view of fully prospecting with drills.

Dona Ana County

ORGAN MOUNTAIN MINING CO. (Las Cruces)—Newly organized company has secured Stephenson-Bennett property and will build mill and do extensive development from 800-ft. level. Wrighter & Leving have lease on property and are making shipments to El Paso smelter.

Grant County

BELL & WRIGHT (Pinos Altos)—Lessees continue to encounter high-grade ore. High-grading has been going on with an estimated loss to firm of several thousand dollars. Ore is being placed in bank at Silver City and will be sent to California smelter. Other companies in district are striking rich ore.

Sierra County

BI-METALLIC MINING CO. (Sierra Blanca)—Equipment is being received for extensive operations in near future.

OREGON

A FIRST ISSUE OF "MINERAL RESOURCES OF OREGON", which will be published monthly by Oregon Bureau of Mines and Geology, has made its appearance. Purpose is to systematize news of mineral development and resources throughout state for limited circulation in bulletin form and chiefly for use in reproduction by press of state.

Baker County

A FALL OF THREE TO SIX FEET OF SNOW in the different camps has brought ore hauling to a standstill.

WOODWARD, MILLER & LANE (Cornucopia)—William Slade, of Reno, Nev., who made a fortune in Baker County mines in early days has just purchased these mine properties for a consideration of \$100,000. Properties consist of nine patented claims and are on Eagle Creek. Slade is planning to install new equipment and will make many improvements.

PENNSYLVANIA

SHIPMENT OF RADIUM FROM PHILADELPHIA was made Feb. 14. Tradesmen's National Bank forwarded on S.S. "Cameronia" approximately 89 milligrams of radium, valued at \$10,000, for account of its Berlin correspondents.

SOUTH DAKOTA Lawrence County

TITANIC (Carbonate)—Shaft is 225 ft. deep. At 300-ft. point lateral work will be started.

IMPERIAL (Trojan)—P. H. Bertschy, who is leasing on Dakota mine, is regularly shipping to New Reliance mill and Denver smelter.

NORTH HOMESTAKE (Maitland)—Plans are maturing for resumption of work at this property. Shaft is 600 ft. deep. Proposed work will include considerable lateral exploration from bottom.

RATTLESNAKE JACK (Galena)—Small sawmill is being installed to get out lumber and timbers for completion of stamp mill. Work on stamp mill is well in hand, and it is hoped to have it in operation by Apr. 1.

TITANIC (Carbonate)—Shaft on Combination claim is 225 ft. deep and good progress is being made. "Jackhammer" drills are used exclusively in sinking. Shaft has recently penetrated mineralized ground, and ore disclosures are anticipated.

ANACONDA (Roubaix)—Company plans to develop ore showings on northern portion of property, either by sinking new shaft or lateral work from present shaft. Funds are being raised, and operations will probably commence before summer.

MINNESOTA (Maitland)—Work of unwatering shaft is progressing at satisfactory rate. Three 8-hr. shifts are employed. Since starting, work has been carried on steadily, except shutdown of three days, caused by breaking pinion of large motor.

MOGUL (Terry)—New 150-ton mill was started Feb. 1, and it is hoped to have it running smoothly at full capacity in a short time. Plant is first in Black Hills to adopt an oil engine for prime mover; De La Vergne engine is used for this purpose. Considerable portion of mining is being done by lessees.

UTAH

American Fork

THERE IS MUCH SNOW IN AMERICAN FORK CANYON at this season, 6 ft. on level and as high as 30 ft. in gulches. Some slides have occurred. Recent strike in Dutchman made by lessees has been productive of high-grade lead-carbonate ore, which is being sacked. Pacific company is making arrangements for increased activity during coming season.

Beaver County

LADY BRYAN (Milford)—A recent strike of good ore has been made on 300-ft. level.

SOUTH UTAH (Newhouse)—This company's mill is being run below normal capacity, caused partly by a reduction of power following heavy snowfall in vicinity of Beaver River Power Co.'s power plant, from which South Utah gets its supply.

Box Elder County

WELL NEAR BRIGHAM CITY being driven for gas or oil is down 1700 ft., and bedrock has not yet been reached. Some gas has been encountered.

GINZA (Strevell)—Development work is being done on these claims northeast of Century mine. Rock carrying copper has been opened.

Juab County

UTAH MINE (Oasis)—This property at Fish Springs has been under development, and is in better condition than at any time during past year. Some ore is being shipped. Development has never been attempted below water level, encountered at 800 ft., owing to high cost of power. Dumps are being worked by lessees, who are making high-grade concentrates by jigging.

Salt Lake County

ROAD FROM TANNER'S FLAT TO WASATCH in Little Cottonwood has been opened, and ore hauling from tonnage accumulated during snowed-in period has been started.

WASATCH MINES (Alta)—A shipment is being made from ore opened near a large stope worked several years ago, in Columbus Consolidated ground.

BINGHAM MINES (Lark)—This company's Yosemite mine is producing several cars of ore per month, from 500-ft. level. Development is being done on 800- and 1100-ft. levels.

UTAH COPPER (Bingham)—Some trouble has been experienced recently on account of ore freezing in cars and in bins. It has been necessary to use dynamite. Both Arthur and Magna mills have been operated at reduced capacity.

Summit County

SILVER KING COALITION (Park City)—A large electric motor as well as other machinery for large station on Alliance tunnel level has arrived, and is being hauled to mine.

THOMPSON-QUINCY (Park City)—During January, 63 mine cars of first-class ore and 40 mine cars of mill ore were taken out, largely from development. A shipment of 32 tons was made.

Utah County

SANTAQUIN KING (Santaquin)—Ore has been found near a cave opened in driving from main tunnel.

LOWLAND TUNNEL WATER & TRANSPORTATION (Santaquin)—Work is progressing in this company's tunnel, which is in 225 ft. Face is in quartzite mineralized with iron.

WYOMING

Crook County

WARREN PEAK MINES CO. (Sundance)—This company has just received patent to 392 acres of mineral land in Bear Lodge district, first mineral patent to be issued. Considerable development has been done on property, and equipment includes boilers, air compressor, drills, sawmill, etc., but pending settlement of patent proceedings, work has been curtailed. District shows large dikes of phonolite. Alongside some of these are small bodies of sylvanite ore, making an extremely attractive proposition for prospecting.

CANADA

British Columbia

NEW U. S. TARIFF EFFECT is that Slocan mine owners can handle at a profit ore running 5 to 6% less in zinc than under former conditions. One mine is now shipping 36% ore to a U. S. smelter, while formerly 42% ore was the lowest grade shipped.

A DISCOVERY OF PITCHBLEND AT LAJOIE FALLS, in the Bridge River section of the Lillooet district, has been announced. The find was made by Joseph Z. Lajoie two years ago, who did not locate it at the time because he thought it unworkable. Work will be commenced on property this spring.

BRITANNIA MINING & SMELTING CO. (Britannia Beach)—During past year company, owning Britannia mine on Howe Sound, acquired nearly all the mineral claims adjacent to and along strike of mineralized zone, thereby securing a solid block of ground nearly five miles east and west by about one mile north and south. Company has shown by its workings in what is known as the Fairview zone that mineralization extends to a depth of over 2000 ft. below summit. This zone has a length of 1200 ft. and is approximately 500 ft. wide. Ore occurs in slates and dolomite-porphyrates, latter crushed to green chloritized schist; mineralized schist and slate being an inclusion in coast-range granites. Production in 1913 was 212,000 tons of ore, containing 1.5% copper, 40c. in gold and 0.5 to 1 oz. silver per ton. In treating low-grade ore concentration is used and most successful process so far tried has been Minerals Separation flotation process. Equipment is to be enlarged soon by installation of a new concentrator with a daily capacity of 2000 tons. System of transportation of ores from mine to beach is being improved by construction of a double-track, gravity, tramway one mile long with an average grade of 15%; also a switchback track five miles long with 3% grade, on which gasoline locomotives will be used.

Ontario

POWER WAS OFF FOR FOUR DAYS on account of necessary repairs to flume and as a consequence, all mills in camp were closed down with exception of the Dome. This company has an auxiliary steam plant sufficient to enable it to carry on operations.

KIRKLAND LAKE GOLD MINES (Swastika)—These mines have been sold to English people.

McINTYRE (Schumacher)—At a special meeting held in New York, directors decided to reduce par value of stock from \$5 to \$1.

DOME (South Porcupine)—Good progress is being made with construction of addition to mill which it is expected will be in operation by May 1.

DOME LAKE (South Porcupine)—New electrical equipment will soon be in place and mill will re-commence operations. Company believes that when once started they will be able to produce steadily at rate of 50 tons per day.

KIRKLAND LAKE PROPRIETARY (Swastika)—Recently \$25,000 was paid on properties which are being taken over by this company. Other payments calling for a considerable amount of money will be made within the next two weeks.

VIPOND (Timmins)—It is stated that control of this property has been purchased by Associated Gold Mines of Western Australia, which already owns North Thompson property adjoining. Details regarding price have not been made public.

EASTWOOD SYNDICATE (Swastika)—This company has been formed for the purpose of developing seven properties in Munro and Gulbord Townships. H. S. Johnson, who reported on Tough-Oakes property in behalf of Kirkland Lake Proprietary, advises development of all known veins as soon as power is available. Provision for an ample supply of electric power is recommended and also erection of a reduction plant of sufficient size for a customs plant for all the properties in the vicinity.

MEXICO

Jalisco

CUCHARA—This old property, which has yielded several bonanzas, is now being prospected at depth. Mill is running on custom ores.

Tepec

DOLORES—Bandits recently raided this property in Ixtlan del Rio district, taking supplies worth several hundred pesos. Work had been suspended a short time before, due to unsettled conditions. Mine is owned by La Dicha Mining & Milling Co., of San Antonio, Texas.

EAST AFRICA

MAGADI SODA CO.—Further capital is now being raised. Company was formed in 1911 by group controlled by Sir Marcus Samuel, head of Shell oil combine. Purpose of company was to develop natural soda deposits of Lake Magadi in East African Protectorate. In order to do so first thing necessary was to build a railway 100 miles in length to link existing line with lake. This has been done, and it was then rumored that some difficulties in preparing the soda for commercial use had been experienced; but now it is understood that these difficulties, if they existed, have been surmounted and the 25% of unpaid capital on ordinary shares is to be called up.

VENEZUELA

VENEZUELAN OIL CONCESSIONS CO.—It is rumored that negotiations are in progress for acquisition by Shell-Royal Dutch Petroleum group of properties of this company, which has concessions over about 3000 square miles in Venezuela, but its capital at present is only £150,000. Some time ago it was stated that the Shell group as well as Standard Oil Co. were prospecting in Venezuela, and it is now understood that Standard Oil interests, operating through the Caribbean company, have struck oil in promising quantities. According to rumors the Venezuelan Oil Concessions are located close to the Caribbean company's properties, and if the present negotiations are carried through the two interests would be operating side by side in Venezuela. It is also rumored that if a deal is arranged the capital of the Venezuelan Oil Concessions Co. is likely to be increased to £1,500,000.

The Market Report

METAL MARKETS

NEW YORK—Feb. 25

All of the metals during the last week have been dull and the markets have been recessional.

Copper, Tin, Lead and Zinc

Copper—The market has been quiet and recessional. Consumers, both in Europe and this country are holding back, notwithstanding the fact that the statistical position of the metal is generally recognized to be a sound one. While the largest agencies, confident of improvement in the near future, have maintained their previous asking price of 14½c., delivered, usual terms, the smaller agencies and second hands have developed what business they could by offering concessions. The volume of business that has been contracted has been small, but still sufficient to reduce considerably the quantities of copper available outside of the larger producers. In the early part of the week some sales of copper were reported at 14.55@14.60c., delivered in Europe, and some domestic business was done with manufacturers in Connecticut at 14½c., delivered, usual terms. These prices were equivalent to about 14.35c., cash, New York. During the latter part of the week quotations became quite nominal, the actual business reported being insignificant, but copper continued to be offered by first hands at 14½c., delivered, usual terms.

The market for Lake copper remains about as previously reported. One company has the bulk of the supply and consumers who want its special brands pay its price. The other producers are beginning to be able to sell small lots. Some small sales at 14.80c., net cash, have been reported. These were for delivery in the West, figured on New York basis of settlement.

The average of electrolytic quotations for the week is 14.36 cents.

The London standard market has been dull, and has fluctuated within narrow limits, around £64 10s. @ £64 15s. for spot and £65 @ £65 10s. for three months. At the close, the market is quoted £64 6s. 3d. for spot and £64 18s. 9d. for three months.

Base price of copper sheets is now 20c. per lb. for hot rolled and 21c. for cold rolled. The usual extras are charged and higher prices for small quantities. Copper wire is 15¼ @ 16c., carload lots at mill.

Exports of copper from New York for the week were 4366 long tons. Our special correspondent reports no exports from Baltimore for the week.

Tin—Heavy buying the middle of last week by American consumers at the then ruling level of prices brought about an improvement in the London market. This, however, was of short duration. The decline in the quotations made further progress at the beginning of this week, and as the trade has become distrustful of the market, buying has ceased almost entirely. The market closes weak at about 38¼c. for March tin here; £173 15s. for spot and \$175 15s. for three months in London.

Imports of Bolivian at Liverpool in January were 1729 tons concentrates and 30 tons bars, the whole equal to 1067 tons fine tin.

Shipments of tin from the Straits in January were 5327 tons. The January output of the Federated Malay States was 4576 tons.

Lead—The price of the American Smelting & Refining Co. has remained 4c., New York. Independent producers report small sales at that price. Reports from St. Louis have been contradictory, offers to buy at 3.87½c. and to sell at 3.85c. being reported from different quarters on the same day. Some producers have maintained an asking price of 3.92½c., without, however, making any sales. The demand has been extremely light and buyers timid. In fact the actual business reported during the week has been insignificant and quotations of the market are based chiefly on bids and offers.

At London good Spanish lead is quoted £19 12s. 6d.; English lead, 12s. 6d. higher.

Spelter—This market, like the others, has suffered from flat demand. Some interests have maintained an asking price

of 5.25c., St. Louis, but others have sought to draw out buyers by offering concessions, spelter being obtainable right through the week at 5.20c. In the early part of the week some tonnage was sold at 5.20c. On Feb. 24 it was found that buyers could be interested at 5.15@5.17½c., and sales were made thereat. Galvanizers do not report any recession in their business, but apparently are taking their time about making contracts for spelter. On the other hand, the smelters generally are confident of their position, in spite of the large stocks that they are carrying, and are not exerting any pressure to sell.

London is unchanged; good ordinaries are quoted £21 10s. and specials £22 5s. per ton.

Base price of zinc sheets is unchanged at \$7.25 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS

NEW YORK

Feb.	Sterling Exchange	Silver	Copper		Tin Cts. per lb.	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.		New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
19	4.8585	57½	14½ @ 15	14.35 @ 14.45	39½	4.00	3.87 @ 3.92	5.35 @ 5.37	5.20 @ 5.22
20	4.8585	57½	14½ @ 15	14.30 @ 14.40	39½	4.00	3.87 @ 3.92	5.32 @ 5.37	5.17 @ 5.22
21	4.8585	57½	14½ @ 15	14.30 @ 14.40	38½	4.00	3.85 @ 3.90	5.32 @ 5.37	5.17 @ 5.22
23	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	4.8585	57½	14½ @ 15	14.30 @ 14.40	38½	4.00	3.85 @ 3.90	5.30 @ 5.35	5.15 @ 5.20
25	4.8565	57½	14½ @ 15	14.30 @ 14.40	38½	4.00	3.85 @ 3.90	5.30 @ 5.35	5.15 @ 5.20

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 0.15c. apart. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic; of casting copper 0.15 to 0.25c. 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, 15½c.; St. Louis-Chicago, 6c.; St. Louis-Pittsburgh, 12½c.; New York-Bremen or Rotterdam, 15c.; New York-Havre, 16@17½c.; New York-London, 16c.; New York-Hamburg, 18c.; New York-Trieste, 22c.

LONDON

Feb.	Copper						Tin		Lead		Zinc	
	Silver £ per Ton	Spot		3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.	
		£ per Ton	Cts. per Lb.									
19	26 1/8	64 1/2	14 09	65 1/2	70	180 1/2	182 1/2	19 1/2	4 26	21 1/2	4 67	
20	26 1/8	64 1/2	14 07	65 1/2	70	179	180 1/2	19 1/2	4 24	21 1/2	4 67	
21	26 1/8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
23	26 1/8	64 1/2	14 01	65 1/2	69 1/2	175 1/2	177 1/2	19 1/2	4 21	21 1/2	4 64	
24	26 1/8	64 1/2	14 04	65 1/2	69 1/2	175 1/2	177 1/2	19 1/2	4 21	21 1/2	4 67	
25	26 1/8	64 1/8	13.97	64 1/2	69	173 1/2	175 1/2	19 1/2	4 26	21 1/2	4 67	

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 = 2.17½c.; £15 = 3.26c. = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21½c.

Exports and Imports in the United States of metals other than iron and steel, 11 months ended Nov. 30, in measures usual in the trade:

	Exports		Imports	
	1912	1913	1912	1913
Copper long tons.....	318,454	377,619	165,677	166,910
Tin, long tons.....	556	1,074	47,867	43,101
Lead, short tons.....	60,653	43,200	81,208	54,318
Zinc, short tons.....	6,598	7,717	8,916	6,056
Nickel, lb.....	23,848,873	27,264,652	37,277,632	42,739,204
Antimony, lb.....	50,684	63,620	15,932,324	14,115,311
Aluminum, lb.....	211,036	44,535	18,956,468	21,830,972
Quicksilver, lb.....	22,383	83,732	.....	.....
Platinum, oz.....	.....	1,191	93,223	108,316
Ores, etc.:				
Zinc ore, tons.....	17,815	15,815	51,580	24,683
Zinc in ore, lb.....	13,516,634	11,532,921	36,003,925	24,081,381
Zinc dross, lb.....	406,918	56,696	.....	.....
Zinc dust, lb.....	28,500	186,138	1,071,152	4,047,734
Zinc oxide.....	31,085,506	27,140,578	.....	.....

Copper, lead, nickel and antimony include the metallic contents of ore, matte, etc. The quantity of antimony ore is not reported. Exports include reexports of foreign material. Zinc dust was not reported separately prior to July 1, 1913, so that figures for 1912 are for five months only.

Other Metals

Aluminum—Business is still rather quiet. Prices are easy at 18½@19c. per lb. for No. 1 ingots, New York.

Antimony—A fair jobbing trade continues in evidence. Prices are steady and unchanged. Cookson's is quoted at 7.20 @7.25c. per lb.; Hallett's at 7@7.10c.; while 6@6.15c. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—Business has been fair and prices are unchanged. New York quotations are \$39 per flask of 75 lb. for large lots. Jobbing price is 54c. per lb. San Francisco, \$38.50 per flask for domestic orders. London price is £7 10s. per flask, with £7 quoted from second hands.

Nickel—Quotations for ordinary forms—shot, blocks, or plaquettes—are 40@45c. per lb., according to size of order and quality. Electrolytic nickel is 5c. per lb. higher.

Gold, Silver and Platinum

Gold—Prices of gold on the open market in London were steady at the Bank level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There is still some demand for the Continent. In New York another \$2,000,000 in gold was taken for export to Paris.

Iridium—Demand continues small and there has been no change in prices. Dealers ask \$75@78 per oz., New York, for pure metal.

Platinum—Talk of higher prices still continues, but no advance has been made. Business continues rather quiet. Dealers ask \$43@44 per oz. for refined platinum and \$46@49 per oz. for hard metal. The foreign market is reported firm.

Silver—The undertone continues good. An Indian currency return cabled Feb. 10 to London, shows an increase in the note issue of 5 lakhs, and a decrease of 30 lakhs in the holding of silver rupees.

Silver Movement in France in the calendar year is reported as follows, in values:

	1912	1913	Changes
Imports.....	Fr. 275,051,000	Fr. 389,185,000	I. Fr. 114,134,000
Exports.....	287,800,000	360,132,000	I. 72,332,000
Excess.....	I. Fr. 12,749,000	E. Fr. 29,053,000	.....

Gold and Silver Movement in the United States in January is reported as follows by the Department of Commerce:

	Gold		Silver	
	1913	1914	1913	1914
Exports.....	\$17,237,648	\$6,914,056	\$6,439,015	\$4,009,539
Imports.....	6,210,360	10,451,373	4,201,042	2,318,352
Excess.....	E.\$11,027,288	I.\$3,537,317	E.\$2,237,973	E.\$1,691,187

Exports of merchandise in January, 1914, were valued at \$203,799,517; imports, \$154,459,263; leaving \$49,340,254 as excess of exports.

Zinc and Lead Ore Markets

JOPLIN, MO.—Feb. 21

Zinc blende sold as high as \$46.50, the assay base ranging from \$43@44, the metal base from \$41@42.50 per ton of 60% zinc. Calamine base price is \$21@23 per ton of 40% zinc, and the average of all grades is \$41.20. Lead sold up to \$53, the base price remaining \$50 per ton of 80% metal content, and the average of all grades is \$50.70 per ton.

Aside from one day and night of continuous rain the week has been a fair one for mining operations, but heavy roads interfered with loading, and the shipment is hardly up to expectations. Buying was active and the production was purchased close; one reserve bin of 150 tons was bought for next week's delivery.

SHIPMENTS WEEK ENDED FEB. 21

	Blende	Calamine	Lead	Value
Total this week.....	9,290,000	547,680	1,608,910	\$243,475
Total eight weeks..	78,143,760	4,486,130	14,386,900	2,005,110
Blende value, the week, \$196,620; eight weeks, \$1,594,660.				
Calamine value, the week, \$6040; eight weeks, \$49,610.				
Lead value, the week, \$40,815; eight weeks, \$360,840.				

PLATEVILLE, WIS.—Feb. 21

The jack base price for 60% ore advanced to \$43 per ton this week. The base price paid for 80% lead ore was \$50 per ton, a decided decrease.

SHIPMENTS WEEK ENDED FEB. 21

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week.....	3,210,980	143,500	1,208,860
Year.....	22,155,560	867,860	7,807,270

Shipped during week to separating plants, 3,125,300 lb. zinc ore.

IRON TRADE REVIEW

NEW YORK, Feb. 25

The iron and steel markets continue to show a moderate degree of improvement. Specifications are coming in steadily and the mills are gradually increasing their rate of working. The recent advances in price are generally pretty well held; at any rate, there is no recession to be noted.

Activity in the steel market is clearly settled down to specifying on a liberal scale on contracts made recently, largely in January, with a decrease in the amount of strictly new business. Specifications are running at a better rate than the January average, and as the present mill operations, about 70% of capacity, are based chiefly on the rate of specifying in January, there is promise that the present rate of output can easily be maintained for some time. Spring demands of the general trade, and an increase eventually in railroad buying, are expected in the not distant future to put the industry on a still more active level. Between movements there is the possibility of a slight weakening in prices.

Rail orders have come in rather slowly, but there have been more orders for cars and locomotives reported recently.

Pig-iron sales are reported on the increase, both for basic and foundry iron. In this market prices are reported firmer than they have been.

R. D. Wood & Co., Philadelphia, have been awarded a contract for 45,000 tons large cast-iron pipe for an aqueduct in the Apulian district in Italy.

PITTSBURGH—Feb. 24

The cold weather of the past few days, the zero line having just been passed early this morning, together with additional heavy snows, have somewhat interfered with steel-mill operations in the Pittsburgh, Valley and Wheeling districts, but the reduction in output is not large. The movement of coke is not blocked, but coke is longer in transit. At a very few operations coke could not be drawn on the days intended, through inability to secure empties. Of much more importance, perhaps, is the extremely heavy snowfall. All records for the season were passed 10 days ago, since when there have been two heavy falls in addition, and in certain circumstances heavy floods may occur this spring, and any flood above the record is likely to do serious damage to some of the iron and steel plants lining the rivers.

Steel prices have not weakened in the past week or two, but it is clear that some of the advances announced so freely at the beginning of the month did not develop into actual market advances. Bars and plates can still be secured at 1.20c. for early delivery, and in some instances this price can be done on shapes also. The Carnegie Steel Co. holds to 1.25c. on the three products, and will not book open contracts for a longer period than three months. Other mills, as a rule, quote this price for second quarter, though usually willing to shade it for early delivery. Wire products are a trifle less active, though shipments are still good. Sheets have not absolutely firmed up to 2c. on black and 3c. on galvanized, though for two or three weeks these figures have been the minimum of producers making perhaps 75% of the total output.

Pig Iron—The market is extremely quiet again, but by reason of the good sales lately made it has lost none of the strength shown by the slight price advances. The furnaces in operation appear to be comfortably sold up. With coke stiffening, and a small reduction, or none at all, promised in ore, when a considerable reduction had been discounted, idle furnaces are indisposed to blow in unless the market experiences a very considerable advance. We quote: Bessemer, \$14.25; basic, malleable and foundry, \$13.25; forge, \$12.75 @ 13, at Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—It appears that consumers did not all cover at recent low prices, though altogether a very large tonnage was sold at \$35@37. The market for both English and German is now firm at the level quoted a week ago, \$39, Baltimore.

Steel—A few lots of sheet bars have been sold at \$22, but in general the market is quiet, though firm, at the recently advanced prices, \$21 for billets and \$22 for sheet bars, with \$1 additional for second quarter, f.o.b. maker's mill, Pittsburgh or Youngstown. Forging billets have been steadily firming up and are now quotable at \$26, Pittsburgh. Rods are \$26@27, Pittsburgh.

COKE

The Maryland Steel Co. is understood to have purchased 10,000 tons of coke for March delivery at \$2, ovens, and to be negotiating further for an equal tonnage for March, while prices for second quarter are also being considered. There is some \$2 coke available for second quarter, but most producers are asking more. It is understood that the Jamison Coal & Coke Co., which has a contract to supply the Tonawanda Iron & Steel Co., has made a purchase against its contract, taking something like 9000 tons a month over the balance of the year from the Producers' Coke Co., at \$2.25, the coke to be shipped in box cars. In view of the usual scarcity of box cars, and the extra expense involved in loading, as well as the long delivery period, the trade at large considers the reported price as low. Odd lots of spot coke continue to go at \$1.90, though any considerable demand would easily send the market up to \$2 per ton.

Coal Trade on the Lakes for three seasons past is reported as follows, the statistics being collected by the "Marine Review" of Cleveland. The figures are short tons:

	1911	1912	1913
Anthracite.....	3,917,419	4,204,741	5,033,696
Bituminous:			
Pittsburgh, dis.....	10,611,941	11,300,000	13,415,473
Ohio.....	4,019,544	4,676,000	6,176,624
West Virginia.....	7,151,200	7,360,000	8,736,586
Total bituminous.....	21,782,685	23,336,000	28,328,683

The total of all kinds in 1913 was 33,362,379 tons, which is the heaviest season business ever reported. The Pittsburgh district kept its position as the leader in supplying Lake coal.

Coal and Coke Moved on Pennsylvania R.R. lines east of Pittsburgh and Erie month of January, short tons:

	1913	1914	Changes
Anthracite.....	1,014,259	915,027	D. 99,232
Bituminous.....	4,210,196	4,117,514	D. 92,682
Coke.....	1,288,514	853,412	D. 435,102
Total.....	6,512,969	5,885,953	D. 627,016

The total decrease this year was 9.6%. Two-thirds of the loss in tonnage was in coke.

SAULT STE. MARIE CANALS

The total freight reported by the superintendents as passing through the Sault Ste. Marie Canals in the season of 1913 was 79,718,344 short tons, an increase of 7,245,668 tons, or 10%, over 1912. The total number of vessel passages in 1913 was 23,795, showing an average cargo of 3350 tons. Of the vessel passages 19,789 were steamers, 1992 sailing vessels and 2014 rafts, small boats and other unregistered craft.

Mineral freights included in the totals were as follows, in short tons, except salt, which is given in barrels:

	1912	1913	Changes
Anthracite.....	2,142,485	2,744,574	I. 602,089
Bituminous coal.....	12,789,109	15,878,364	I. 3,089,255
Iron ore.....	46,303,423	48,109,353	I. 1,805,930
Pig and m'f'd iron.....	654,892	402,912	D. 251,980
Copper.....	116,954	85,378	D. 31,576
Building stone.....	2,282	6,181	I. 3,899
Salt, bbl.....	660,991	730,431	I. 69,440

Iron ore was 60.3% and coal 23.4% of the total freight in 1913. The United States canal was open from Apr. 18 to Dec. 18, or 245 days; the Canadian canal from Apr. 14 to Dec. 15, or 246 days.

CHEMICALS

NEW YORK—Feb. 25

The general market has been quiet with no special activity, and no material changes in price.

Arsenic—Business continues dull and sales light. Quotations are easy at \$2.75@3 per 100 lb., and might be shaded on a large order.

Copper Sulphate—Business is fair but not specially active. Prices are unchanged at \$4.80 per 100 lb. for carload lots and \$5.05 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is moderately active. Quotations here are firm at 2.25c. per lb. for all positions.

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.

	September	October	November	December	January
Alaska shipments	2,261,216	1,951,883	3,391,300	3,104,155	2,701,258
Anaconda.....	22,600,000	18,400,000	25,250,000	25,100,000	24,400,000
Arizona, Ltd.....	1,800,000	3,550,000	2,800,000	1,920,000	3,474,000
Copper Queen.....	8,434,803	8,292,929	7,115,991	9,033,459	.....
Calumet & Ariz.....	4,000,000	4,500,000	4,600,000	5,230,000	5,975,000
Chino.....	4,196,296	4,767,466	4,270,821	4,390,018	.....
Detroit.....	2,102,818	1,861,878	1,922,352	2,021,034	.....
East Butte.....	1,233,018	1,040,997	1,002,190	1,324,560	.....
Giroux.....	198,178	156,084	250,000	.....	.....
Mason Valley.....	918,000	1,032,000	1,174,000	1,400,000	1,625,000
Mammoth.....	1,750,000	1,700,000	1,700,000	1,400,000	1,625,000
Nevada Con.....	4,441,671	5,898,046	5,443,647	5,343,862	5,791,122
Ohio.....	685,900	698,601	772,120	722,940	.....
Old Dominion.....	2,679,000	2,037,000	2,450,000	2,613,039	2,797,000
Ray.....	4,336,434	4,725,419	4,753,964	5,075,202	5,705,000
Shannon.....	1,233,000	1,216,000	1,110,000	1,073,000	.....
South Utah.....	241,843	232,269	225,072	.....	.....
Tennessee.....	1,309,985	1,392,162	1,666,753	1,700,000	1,474,890
United Verde*.....	3,000,000	3,000,000	3,000,000	3,000,000	.....
Utah Copper Co.....	11,463,905	9,929,478	10,787,426	10,306,646	10,329,564
Lake Superior*.....	6,950,008	5,500,000	6,600,000	5,600,000	7,400,000
Non-rep. mines*.....	6,000,000	6,200,000	6,000,000	6,250,000	.....
Total prod.....	91,836,075	88,102,302	96,285,636	.....	.....
Imp., bars, etc.....	35,703,660	21,935,023	21,796,866	23,578,938	.....
Total blister.....	127,539,735	110,037,325	118,082,502	.....	.....
Imp. ore & matte.....	10,800,162	5,062,015	8,980,186	12,205,187	.....
Total Amer.....	138,339,897	115,099,340	127,062,688	.....	.....
Miami.....	2,688,000	2,862,050	3,230,000	3,210,000	3,258,950
Shattuck-Arizona	1,163,237	993,224	995,429	1,050,781	1,276,636
Brit. Col. Cos.:					
British Col. Cop.....	621,120	688,581	.....	.....	.....
Granby.....	1,824,659	1,718,258	1,944,145	1,605,382	.....
Mexican Cos.:					
Boleo.....	2,369,920	2,424,800	2,315,040	2,315,040	2,369,920
Cananea.....	3,148,000	3,682,000	3,800,000	3,646,000	3,480,000
Moctezuma.....	3,024,121	3,178,136	3,517,800	3,139,613	.....
Other Foreign:					
Braden, Chile.....	1,332,000	2,006,000	1,592,000	2,122,000	2,430,000
Cape Cop., S. Af.....	607,040	712,320	649,600	683,200	519,680
Kyshtim, Russia.....	1,187,000	.....	.....	.....	.....
Spasky, Russia.....	1,025,920	983,360	904,960	900,480	.....
Exports from:					
Chile.....	5,600,000	6,160,000	7,616,000	10,640,000	5,488,000
Australia.....	6,944,000	7,728,000	11,200,000	6,720,000	5,712,000
Arrivals—Europe†	9,661,120	18,040,960	9,107,840	13,787,200	8,599,360

† 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. Ref'n'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
II, '13.	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III.....	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.....	.....	.....	.....	87,296,685	50,108,800	137,405,485

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

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 1912 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 1912 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 1912 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 1912 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 1912 to 1914.

STOCK QUOTATIONS

Table of stock quotations for Colorado Springs and Salt Lake, Feb. 24.

TORONTO

Table of stock quotations for Toronto, Feb. 24.

SAN FRANCISCO

Feb. 24

Table of stock quotations for San Francisco, Feb. 24.

N. Y. EXCH.

Feb. 24

Table of stock quotations for New York Exchange, Feb. 24.

N. Y. CURB

Feb. 24

Table of stock quotations for New York Curb, Feb. 24.

BOSTON CURB

Feb. 24

Table of stock quotations for Boston Curb, Feb. 24.

LONDON

Feb. 13

Table of stock quotations for London, Feb. 13.